KENYA'S ADAPTATION TO THE IMPACTS OF CLIMATE CHANGE ON SUSTAINABLE FOREST MANAGEMENT: CAN ADAPTIVE CAPACITY BE MEASURED AND STRENGTHENED?

A Thesis Submitted to the College of

Graduate Studies and Research

In Partial Fulfillment of the Requirements

For the Degree of Master of Public Policy

In the Johnson Shoyama Graduate School of Public Policy

University of Saskatchewan

Saskatoon

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ABSTRACT

Kenya is currently experiencing the effects of climate change on its environment and urgently needs credible adaptation strategies for its forests, which provide key ecosystem services. Climate adaptation is a dynamic social and institutional process where the governance dimension is receiving growing attention. As uncertainty is an inherent feature of climate adaptation, I argue that climate adaptation governance would benefit from systematic and yet flexible decision-making tools and methods such as collaborative management for the implementation and evaluation of adaptation options, and that these methods can be linked to key adaptive governance principles. Noting that the criteria and indicators of Sustainable Forest Management (SFM) make few references to policy and governance, the thesis argues that, in the context of SFM and development, policy capacity will be needed to achieve SFM goals threatened by climate change and should be reflected in the criteria and indicators. The thesis reviews the debate about the relative importance of central and decentralized policy capacity in developing countries and, using indices measuring vulnerability to climate impacts and policy capacity in Kenya and other countries, argues that policy capacity plays a significant role in a country's ability to adapt to the effects of climate change.

Key Words: Sustainable Forest Management, Policy Capacity, Adaptive Capacity, Climate Change, Policy Capacity and Adaptability

ACKNOWLEDGMENTS

I am grateful to the members of my Advisory Committee for their mentoring and guidance. First, my utmost gratitude goes to my supervisor Dr. Jeremy Rayner for his guidance, patience, encouragement and insightfulness as I worked on this research. I would also like to thank Dr. Peter Phillips for his incisive guidance and for pushing me to think more critically about my research design and analysis. I am grateful to Dr. Ken Coates for bringing fresh and critical perspectives to this research. And many thanks also go to Dr. Maureen Reed for her contributions to this research in its initial development.

I would also like to recognize my mentor, Dr. Reg Urbanowski. Thank you for your words of encouragement throughout this process.

This process would not have been possible without the support and enthusiasm from my parents and siblings. I am so very thankful for you all. It was made also much easier in the company of fellow students and friends. In particular, many thanks go to Claire, Kush, Boa, Shirley, Rahab and Obeyaa for their counsel and friendship. And, ultimately, I am forever grateful for the love, steadfast support, encouragement, and wisdom of Kevin throughout this period. Thank you for being my number one cheerleader.

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LIST OF ABBREVIATIONS

ACM - Adaptive Collaborative Management

C&I- Criteria and Indicators

CPI – Corruption Perception Index

EPI - Environmental Performance Index

EVI – Environmental Vulnerability Index

GOK – Government of Kenya

PSC – Public Sector Capacity

PCA – Policy Capacity and Adaptability

SFM – Sustainable Forest Management

WGI – Worldwide Governance Indicators

CHAPTER ONE

INTRODUCTION

Forests provide numerous benefits to society**.** They contribute significantly to people's livelihoods through the provision of environmental services such as biodiversity, recreation, wildlife habitat, clean air and water, as well as contributions towards economic growth. The forestry sector in Kenya, for example, contributes in excess of $285.7 million (Ksh. 20 billion) annually to the economy and employs over 50,000 people directly and another 300,000 indirectly (Kenya Forestry Service, 2009). Forests also play an important role in cultural and spiritual traditions and, in certain situations, are fundamental to the survival of some cultures and people.

Despite the positive contributions of forests to society, the last quarter century has witnessed a growing body of research and studies showing the strains on the world's forests (Zbinden & Lee, 2005; Holl et al., 2000). These research initiatives cover a range of issues concerning forest ecosystems such as biodiversity loss, species decline, and deforestation and have indicated worsening scenarios in the world's forests.

Sustainable Forest Management (SFM) has been suggested as one way to tackle the multiple challenges facing the world's forests, with declarations being published at both national and international levels in which SFM is promoted as the main vehicle for improving the outcomes of forest management (FAO, 2011; Schanz, 1998; Matiru, 1999; McGinley & Finegan, 2003). However, despite efforts by international development agencies, environmental groups, and other forestry stakeholders at assisting countries to improve governance in the sector, there has been limited success in slowing down challenges such as deforestation. Global deforestation occurs at a fast rate, around 13 million ha/yr., with South America and Africa experiencing the largest losses (OECD, 2007).

SFM's inclusion of good governance and sound forest policy among the criteria of SFM has drawn attention to the contribution of poor governance and problems with the rule of law in failing to stop deforestation and forest degradation. Addressing illegal logging, corruption and other forest crimes e.g. wildlife poaching, trade in endangered species, arson and theft, unlawful occupation of forest land, international trade in protected species, logging outside concession boundaries, logging in protected areas, under grading and misclassifying species, timber smuggling, transfer pricing in timber trade, and timber processing without a license is as important as developing the scientific and technical side of forest management if the world's forests are to be saved (Kishor & Belle, 2004).

Climate change and its effects on the environment also pose an additional challenge to achieving the goals of SFM. Africa's major economic sectors, agriculture and tourism, are dependent on natural resources, including forests, which are vulnerable to any climatic changes. This vulnerability is made worse by existing development challenges such as pervasive poverty, limited access to capital including markets, infrastructure and technology; ecosystem degradation; and complex disasters and conflicts. Climate change is already affecting Kenya's forests and is expected to continue to do so in the foreseeable future. Impacts observed to date include droughts and severe flooding in some parts of the country. Climate change also results in impacts on forest growth rates, the distribution of tree species, the rate of ecosystem processes and the ability to carry out forest operations with increased severity of impacts experienced by forest-dependent communities (Johnston et al, 2010).

Forest ecosystems and, by extension, forest dwelling and forest-dependent communities, possess some natural capacity to adapt to the effects of climate change. Forests may persist in the face of drought or the increasing severity of pests and diseases by changing the extent and composition of different tree species under selection pressures while more resilient species or sub-species can be introduced through management interventions. Communities may be able to survive by adapting their own behavior to the new composition of the forest, especially if the changes proceed slowly enough. This is what environmental policy scholars refer to as adaptive capacity, defined as "the ability to adjust, to take advantage of opportunities or to cope with consequences" (IPCC 2014, 215) and has become an important concept in SFM. Increasing attention is now focused on policy and governance arrangements that increase adaptive capacity or compensate for vulnerabilities:

"adaptive approaches to SFM will help to reduce forest vulnerability, maintain forest productivity and foster the adaptive capacity of forest-dependent communities" (FAO, n.d. 9). Pre-existing governance weaknesses, however, contribute to vulnerability and reduce adaptive capacity (Niang et al 2007).

Countries in the developing world such as Kenya continue to create detailed documentation about the issues they face and the specific steps to tackle these challenges[1]; however, implementation of these plans and policies has been a constant challenge. Institutional barriers have been identified as often being the main constraints to adaptation. "Forest policy generally assumes a constant physical environment, yet it is clear that this assumption will be incorrect in the near future. Forest policy will need to evolve in ways that help the sector deal more effectively with uncertainty, surprise and novel conditions, including the effects of climate change" (Johnston et al, 2010). They argue that current policy also often prevents or limits local autonomy in decision making, when in fact, it is at the local levels that adaptation occurs.

For sustainable forest management in an uncertain future, it is vital that stakeholders possess the ability to make innovative and locally relevant decisions related to climate change adaptation. This will equip them with the ability to reduce the potential negative impacts of climate change as well as help identify areas of vulnerability and plan for possible adaptation strategies. The inclusion of the challenge of climate change and adaptation to its effects in environmental policy making, therefore, seems like a logical consideration in forest management planning.

1.2 Purpose of the Study

This thesis reviews efforts to include adaptation in SFM policy planning and how the policy and governance dimension of adaptive capacity can be measured. Measuring adaptive capacity is not a simple matter, in part because scholars of environmental governance continue to disagree about

[1] Some of these policy documents include:
1. The Environment Management and Coordination Act (EMCA) of 1999
2. The Kenya National Environment Action Plan (1994)
3. The Kenya National Environment Action Plan Framework (2009 - 2013)
4. The Kenya Forest Act (2005)

the relative importance of central and local capacities. However, since studies continue to show that local capacity is both constrained and enabled by the larger framework of national policy and governance, the thesis seeks to analyze and evaluate how adaptive capacity at the local level can be complemented by a country's national capacity using Kenya as a case study. Measuring and aggregating adaptive capacity at local scales is a difficult and potentially costly process therefore, if national capacity is an acceptable surrogate, simple and widely available measures could be used to create indices that will provide at least a first approximation of capacity and vulnerability. The study seeks to answer the following question:

Is policy capacity at the national level an adequate of measure of a country's ability to achieve the objectives of Sustainable Forest Management in the face of environmental challenges such as climate change?

The country's forest management policies have in the past assumed a constant physical and policy environment yet scientific evidence shows that the climate is indeed changing and affecting forest ecosystems. The focus has in the past been on issues such as deforestation, illegal forest settlements etc. with climate change impacts and adaptation being pushed to the periphery. Adaptation to this challenge will need to become part and parcel of forest management in Kenya.

Some scholars (Kigenyi et. al (2002), Johnston et al., 2010), have proposed a review of existing forest management policy, particularly the principles, including the Criteria and Indicators (C&I) of SFM and have outlined possible ways these can be modified to accommodate the issue of climate change and the subsequent need for adaptive capacity to be able to deal with negative impacts. In the absence of international agreement on the need for this, countries can meanwhile start working on incorporating the challenge of climate change and the need for adaptive capacity in their immediate and long-term forest management planning policies. The ways in which institutions will need to adapt to the impacts of climate change and indeed what capacities are required for specific adaptation options need to be researched and understood. This is critical to SFM and requires a collaborative management approach involving relevant stakeholders.

This study seeks to reiterate the importance of considering the issue of climate change in Kenya's forest management planning, and the importance of strengthening the country's adaptive capacity

on a number of scales. The study will, therefore, include a discussion on policy capacity and will attempt to operationalize a framework for measuring a country's policy capacity in the hope that this will contribute to an overall understanding of its impacts on adaptive capacity and contribute towards discussions around enhancing the ability of a country to estimate and prepare for uncertainties in forest management.

1.3 Sustainable Forest Management (SFM) in Developing Countries

1.3.1 Definitions

SFM has been proposed as one way to tackle the strains on the world's forests and is widely viewed as a key component of global sustainable development (Kimani, 2008; Schmithüsen, 2002; United Nations Economic Commission for Africa, 2008). Despite the frequent use of the term, there is no universal and detailed definition of SFM and questions have been raised regarding its meanings and functions and its implementation in practical forestry (Global Witness, 2009; World Bank/WWF Alliance, 2003).

When defined from an ecosystem-based management viewpoint, SFM can be said to involve the formulation, articulation, administration and implementation of policies, legislation, regulations, guidelines and norms relating to ownership, access, control, rights and responsibilities and practices for the sustainable management of forests at both local and national levels (FAO, 2011). The Food and Agriculture Organization (FAO) lists equity and justice, empowerment, accountability, transparency, subsidiarity, and sustainability as the key guiding principles of sustainable forest governance.

FAO describes SFM as entailing the preservation all ecosystem services for the present and all future generations which requires attention to a range of issues such as legislation, property rights, capacity for implementation and the need to involve a number of actors (government, local stakeholders, NGOs, the private sector, etc.). For the purposes of my thesis, I adopted the FAO definition of SFM because it encompasses all the important factors that are needed for SFM to be successful especially in a developing country setting like Kenya's where implementation challenges and corruption remain significant. However, a number of alternative definitions exist, providing additional elements of SFM.

The Canadian Forest Service (2011) defines SFM as "management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for present and future generations".

The International Tropical Timber Organisation (ITTO) defines SFM as "the process of managing forests to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity, and without undue undesirable effects on the physical and social environment" (ITTO, 2005).

According to the ITTO (2010), SFM is viewed as having the characteristics of allowing for the socio-economic feasibility of administration and utilization of forest resources, the preservation of ecosystems over time and the ability of various stakeholders to participate in the formulation and implementation of related policies and programs. The use of forests sustainably is therefore valued as a long-lasting activity that accepts intervention in the forest to utilize products and services in a way that:

- occurs within the limits of an ecosystem's sustained productivity over time;
- is economically viable for the stakeholders involved in forest management;
- the stakeholders impacted by these activities have an opportunity to participate in the design, implementation, and evaluation of forest policies and programs, as well as share in the distribution of associated costs and benefits; and
- forestry activities are viewed as connected to other sectors of the national economy and within the framework of the sustainable development of a country.

The Forests Philanthropy Action Network (FPAN) describes SFM as "the de facto forestry approach advocated by many international institutions, donor agencies, and governments". According to FPAN (2011), SFM encompasses a broad range of practices aimed at sustaining a productive supply of products from the forest while reducing the impact of extraction, and also improving the social and economic benefits to local communities. SFM is seen to include many

different forest uses, from logging in timber concessions to the production of other forest products such as honey, rubber or wood fuels. Emphasis is however put on the preservation of forest biodiversity and ecosystem services, and alleviating poverty and protecting rights of forest-dependent peoples.

Since there is no detailed, inclusive definition of SFM, there are instead varying sets of criteria that have been developed through numerous intergovernmental processes since the 1992 Rio Summit that are generally viewed as demonstrative of SFM. The Rio Summit created key documents for forest management known as *Forest Principles***.** These represent an agreement reached by all countries on the role of forests in sustainable development. The Principles illustrated unanimity by countries on the multiple functions and uses of forests, and state that "forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations" (United Nations, 1992).

Two widely adopted approaches to SFM are government forest management and voluntary certification (McGinley, 2008; World Bank/WWF Alliance, 2003). A government approach involves legislation and regulation of forest processes using criteria and indicators at the national level and the forest management unit level. Voluntary certification involves private sector foresters having their operations accredited to an external, third-party standard. In Kenya, all matters relating to forests including SFM are determined at the national level.

1.3.2 Criteria and Indicators for SFM

A criterion (in SFM) describes a set of conditions by which a forest characteristic or management initiative is judged or assessed. Indicators show changes over time for each criterion and allow monitoring of progress towards the goal identified by the criterion. In short, indicators demonstrate how well criteria are being met (ITTO, 2005)

The United Nations Conference on Environment and Development's (UNCED) Rio Declaration and Statement of Principles for the Sustainable Management of Forests was adopted in 1992, with the goal of initiating SFM to ensure" the conservation and maintenance of ecosystem services while still allowing for continual use of forests for economic, social and cultural purposes" (FAO, 2010). Subsequently many other Criteria and Indicator (C&I) frameworks have been advanced,

which shows the growing global demand for socially and environmentally responsible forestry (ITTO, 1999; 2005) with a lot of research being devoted to designing and refining appropriate C&Is to reflect the ecological, socio-cultural, economic and political characteristics of distinct forests (e.g. ITTO/African Timber Organisation Criteria and Indicators, 2003).

International and regional C&Is were created for different forest types, with the objective of generating a shared understanding of what SFM meant within the different forest types (boreal, temperate and tropical forests). At the domestic level, most forest nations have produced and continue to produce C&Is adapted to their national circumstances and values. Many of these C&Is share similar principles, however, there are differences in theme emphasis (social, cultural, economic or ecological), in the diversity of content (Pokorny & Adams 2003), and in their monitoring and reporting requirements (Hickey et al 2005).

Three intergovernmental processes played a significant role in the development of criteria and indicators for SFM. They are:

- Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (1995) also known as the *Montreal Process*;
- Pan-European Criteria and Indicators for Sustainable Forest Management (1998) also known as the *Helsinki Process*; and the
- *ITTO* Criteria and Indicators for the Sustainable Management of Tropical Forests (2005).

Each of these processes recognizes the differences in application and monitoring of the criteria and indicators from country to country, based on national characteristics. These act as strategies of what "national SFM policies should aim to achieve; by endorsing these documents, national governments commit to undertake national processes to achieve compliance with these criteria" (Hajjar, 2009).

ITTO (2005) describes its Criteria and Indicators as providing member countries with an enhanced tool to evaluate changes and trends in forest conditions and management schemes at the national and forest management unit levels. These indicators identify the information required to monitor

change, both in the forest itself (outcome indicators) and in the environmental and forest management systems used (input and process indicators).

The United Nations Forum on Forests (UNFF) summarized criteria from these processes into seven thematic elements to form the main components defining SFM (ITTO, 2011). These themes are now incorporated into the UNFF Non-Legally Binding Instrument on All Types of Forests. The seven elements are:

Criterion 1: Enabling Conditions for Sustainable Forest Management- This covers the general institutional requirements for SFM to succeed. It covers issues like policy, legislation, economic conditions, incentives, research, education, training and mechanisms for consultation and participation.

Criterion 2: Forest Resource Security- This relates to the degree to which a country has a secure and stable forest cover, which could include plantations, to meet the production, protection, biodiversity conservation and other social, cultural, economic and environmental needs of present and future generations.

Criterion 3: Forest Ecosystem Health and Condition - This relates to the situation of a country's forests and the healthy biological functioning of forest ecosystems as forests can be can be affected by a variety of human actions and natural occurrences such as air pollution, fires, flooding and storms, disease etc.

Criterion 4: Flow of Forest Produce - This is concerned with forest management for the production of wood and non-wood forest products in a sustainable manner.

Criterion 5: Biological Diversity - This relates to the conservation and maintenance of biological diversity, including ecosystem, species, and genetic diversity.

Criterion 6: Soil and Water – This criterion is concerned with the protection of forest soil and water.

Criterion 7: Economic, Social, and Cultural aspects - This deals with the economic, social and cultural aspects of the forest such as those contributing to a country's GDP (UNFF, 2008).

The Dry-Zone Africa Process on Criteria and Indicators for Sustainable Forest Management, initiated by Kenya in 1999 under the supervision of FAO and UNEP, identified 7 criteria and 47 indicators for sustainable forest management at the national level[2]. Of special relevance to this study is Criterion 7 which addresses the issue of policy capacity and lists the following governance indicators:

Criterion 7: Adequacy of legal, institutional and policy frameworks for sustainable forest management.

The list of indicators includes:

7.1 Existence of a national forest policy that ensures the integration of forest management in rural land use planning and to the economic and social development strategic framework as well as to the Convention on Diversification Control and Biodiversity.

7.2 Existence of a comprehensive legislative and regulatory framework providing for equitable access to resources, alternative forms of conflict resolution and consideration of land occupancy and cultural rights of local populations

7.3 Institutional, human and financial capacity to implement the national forestry policy, and relevant national and international laws, instruments and regulations

7.4 Research and development capacity

7.5 Existence of incentives for investments in the forestry sector

7.6 Valorisation of local expertise, knowledge, and technologies

7.7 Existence of measures to facilitate the transfer and adaptation of appropriate technologies.

[2] Source: National level criteria and indicators for sustainable forest management in CILSS member countries within the framework of the Dry-Zone Africa. UNEP/FAO/CILSS/CSE National Coordinator Meeting 14-17/12/1999. Dakar, Senegal.

7.8 Existence of an administrative, policy and legal framework for the effective participation of local communities, NGOs and the private sector in forest policy formulation, implementation, and monitoring.

1.3.4 SFM in Developing Countries

The uptake of SFM in developing countries through certification has been described as "low" (Gondo, 2008; Global Witness, 2009; IBRD/World Bank, 2008). The reasons given for this include the costs for both the operator and for governments in incorporating the necessary infrastructure. Gondo (2011) mentions inadequate policy reforms and investment options that support SFM as some of the issues experienced in the conduct of SFM in developing countries stating that it "requires considerable financial resources but so far the financial resources remain inadequate in developing countries". He also cites private sector investment in developing countries as being limited to countries with extensive forests that support conventional extractive industries and export products and private sector investment being restricted by a lack of infrastructure, poorly developed domestic markets and lack of access to finance (Gondo, 2011; FAO, 2010; Matiru, 1999).

Forests certified as being sustainably managed cover approximately 306 million ha of the world's forests (8% of the world's forest cover). The majority of this (about 240 million ha) is in developed countries (World Bank, 2010). Numbers indicate that of the total 3 billion ha of forest resources in developing countries, just 67.5 million ha (about 2.2%) have been certified in accordance with SFM standards. This is despite extensive promotion through intergovernmental and private sector initiatives in developing countries. However, certification at a national level has been embraced by countries with larger forest resources, for example, Brazil's Forest Certification Programme (CERFLOR) and the Malaysian Tropical Timber Council (MTCC).

Although progress towards SFM through third-party certification has been slow, research by the FAO shows that the level of formal forest management in developing countries is higher than presumed, especially in the Asian and Oceania regions with most of these regions having medium to long-term approaches to forest management. While some of these plans are not necessarily

managed in accordance with SFM criteria and indicators, they still have components of the foundations of SFM (FAO, 2011).

In many cases, these plans are required by law and apply to areas considerably larger than areas that have been certified. There are also successful models of SFM in developing countries that have been mandated through legal mechanisms e.g. in Brazil where a decentralised forest management system has had reasonable success in implementing SFM that ensures social monitoring at the local council level.

The Tropical Forest Action Plans (TFAP) in the 1980's created some momentum for forest management. However, it has been shown that national efforts to review forest policies and legislation have been marked by a lack of political commitment and a lack of strong support from decision makers. Governments in power give priority to other sectors such as agriculture, commerce, industry, etc. This relative neglect is compounded by weak analytical, formulation and implementation policy capacity in the forestry sector (Owino & Ndinga, 2004; Gondo, 2010; World Bank/WWF Alliance, 2003).Other factors contributing towards weak implementation of SFM include insecure property rights, high levels of actual and perceived risk, lack of suitable credit options, lack of certification models for plantations, unstable regulatory regimes that discourage sustainable practices, and the technical complexity of certification (Global Witness, 2009, World Bank/WWF Alliance, 2003, McGinley & Finegan, 2003; Kimani, 2008). Also, official development assistance in the forest sector has generally been low especially in developing countries with low forest cover (Gondo, 2010; Mercer et al., 2011).

Some developing countries have tried to address some issues with regard to SFM, particularly the criteria and indicators (C & I), e.g. by participating in the elaboration of regional C&Is e.g. the Dry-Zone Africa, African Timber Organisation led initiative C&Is for humid forests etc. Consultations among African forest experts and stakeholders on this important aspect of SFM, however, remain irregular.

1.4 Conclusion

SFM faces many challenges and climate change and the subsequent adaptation to its effects on the environment poses an additional challenge. For sustainable forest management in an uncertain

future, it is vital that stakeholders possess the ability to make innovative and locally relevant decisions related to climate change adaptation. Local innovation takes place in the context of international initiatives and national forest policy frameworks that ultimately determine a country's ability to reduce the potential negative impacts of climate change, as well as help identify areas of vulnerability and plan for possible adaptation strategies. The inclusion of the challenge of climate change in forest policy-making, therefore, seems like a logical consideration in forest management planning. Nevertheless, developing countries still struggle to implement SFM principles either through private sector initiatives such as certification or through the provision of adequate forest law and policy to be successfully implemented on the ground.

In the following chapter, I discuss the environmental challenges Kenya faces as well as the impacts of climate change on SFM. Chapter 3 is a discussion on environmental governance and looks at alternative approaches to centralized forest management which has been the norm in developing countries such as Kenya. Chapter 4 covers the topic of policy capacity and its contributions to the ability of countries to deal with environmental challenges e.g. issues posed by climate change. In this chapter, I will also introduce one way to measure policy capacity using the Polidano Index as a reference. The final chapter operationalizes the Polidano index using Kenya and other countries similarly situated with respect to the challenges of implementing SFM.

CHAPTER TWO

KENYA - OVERVIEW

Kenya, a country located in East Africa, is endowed with significant biodiversity and a range of landscapes, from the snow-capped Mt. Kenya to savannah grasslands, arid and semi-arid lands, and a coastal strip along the Indian Ocean. The Great Rift Valley runs the length of the country, with mountain ranges on the western and eastern borders and lakes on the valley floor. About 28% of the country is composed of marine ecosystems while the rest (about 72%) are terrestrial.

Kenya's population (about 40 million) is unevenly distributed and ranges from about 300 people per square kilometer (sq.km) in areas with high agricultural potential to as low as three people per square kilometer in arid and semi-arid lands. About 18% of the country is classified as being of high agricultural potential; arid and semi-arid lands occupy 80% of the country and lakes make up the remaining 2% (KNBS, 2012). According to the United Nations Development Programme (UNDP), about 50 percent of Kenyans lived below the poverty line in 2005, majority of whom are dependent on the country's natural resources.

Forests serve a myriad of important functions in Kenyan society. They act as water catchment resources and carbon sinks and provide food, wood fuel, fodder, pasture and medicinal material for an estimated 80% of about 1 million of households living within a stretch of 3km from forest boundaries (Ministry of Energy, 2002). Also, the majority of households in Kenya's informal settlements depend on wood fuel as the main source of energy for cooking and heating. As mentioned before, the country's forest cover has declined over the years to as low as less than 2% cover which falls way below the globally recommended cover of 10%. This has been largely attributed to human activities such as illegal logging, unsustainable charcoal production and clearing of forests to create land for farming and settlement. The distribution of forests in Kenya

is determined by rainfall, one of the most affected climatic components; hence the survival of Kenya's forest resources is likely to be severely affected by climate change.

2.1 The Socio-Economic Policy Context

Kenya experienced reasonably high economic growth during the first two decades following its independence from Britain in 1963, a period that saw major improvements in people's livelihoods. The late 1980s were however marked by economic deterioration. By 2001, over half of the Kenyan population lived below the UN-defined poverty line of 1 US dollar a day.

In 2002, the general elections were held and won on a platform of change. The new coalition government established a commission to fight corruption and developed a new national strategy, the Economic Recovery Strategy for Wealth and Employment Creation (ERS), which was launched in June 2003. Fragmentation within the government, however, led to poor implementation and eventual collapse; despite the positive economic performance indicators experienced by the country.

Despite the political upheaval at the time, the Kenyan economy saw a period of strong economic growth from the early 2000s, realizing a growth rate of over 6% in 2006/07. Continued economic growth took place across the whole economy in agriculture, tourism, manufacturing, wholesale and retail trade, telecommunications, as well as in the social sectors. This broad-based economic growth led to a reduction in poverty levels from 56 % in 2002 to 46% in 2006.

The country's economic situation has recently deteriorated due to the global financial crisis, coupled with a serious drought in 2010/2011. The government's latest development strategy, Vision 2030, was created with the goal of securing a growth rate of 10% per annum from 2012, on average up to 2030. Most development organizations and scholars agree that this rate of growth is largely dependent on the implementation of good policies and the establishment of strong and effective national institutions; and that such growth is dependent on the effective management and performance of the country's natural resources.

2.2 The Socio-Political Policy Context

The country`s political environment (the 2007 post-election ethnic tensions and resulting violence, the coalition government created afterwards and its internal struggles, the new constitution of 2010, and the 2012 election campaigning) has had a major impact not only on the implementation of all major reforms but especially reforms related to land issues and wider forestry and environmental programmes.

Forest management has been heavily centralized in Kenya as a legacy of the colonial period, with the government taking a direct interest in all aspects of planting, cultivation, harvesting, and processing. The Forest Department (FD) under the direction of the Ministry of Environment and Natural Resources (MENR) has traditionally exercised control of forests and most of what pertains to their management.

"The political will to conserve forests has been inconsistent (therefore) interfering with professional forest management. Quite often, forest management decisions have been made on political considerations, examples include the "ban" on timber harvesting, the public announcement on removal of eucalyptus trees and the ban on grazing in all forests" (Oksanen et al, 2011).

Corruption and political interference in the running of local authorities has for a long time been widespread and has contributed to the loss of some of the local forests through expansion of agricultural land, charcoal burning, timber extraction and allocation of forestland (Transparency International, 2011). The establishment of the Kenya Forest Service (KFS) in 2005 as a semi-autonomous institution is viewed as an attempt at reducing political interference in the forestry sector and to further forest sector reforms in the country.

2.3 Forest-Related Factors and Historical Development of Forest Use

2.3.1 Forest Resource Context

Kenya has approximately 2.6 million ha of forest with around 2% of the total land area in the country covered by closed canopy forest (1.24 million ha). In addition to closed canopy forest, estimates by FAO in 1994, showed that plantation forests constituted 0.61 million ha. Most of

these resources are found in the Montane Forest Region where 18% of the area is afforested and the Coastal Region where 9.9% of the land surface is forested. Only 1.9 percent (851,000 ha) of the Western Rainforest Region now contains forest because of population pressures, while the figure for the Dry Zone Forest Region is very low at 0.4 percent (211,000 ha). Figure 1.1 below shows the basic distribution of forests in Kenya.

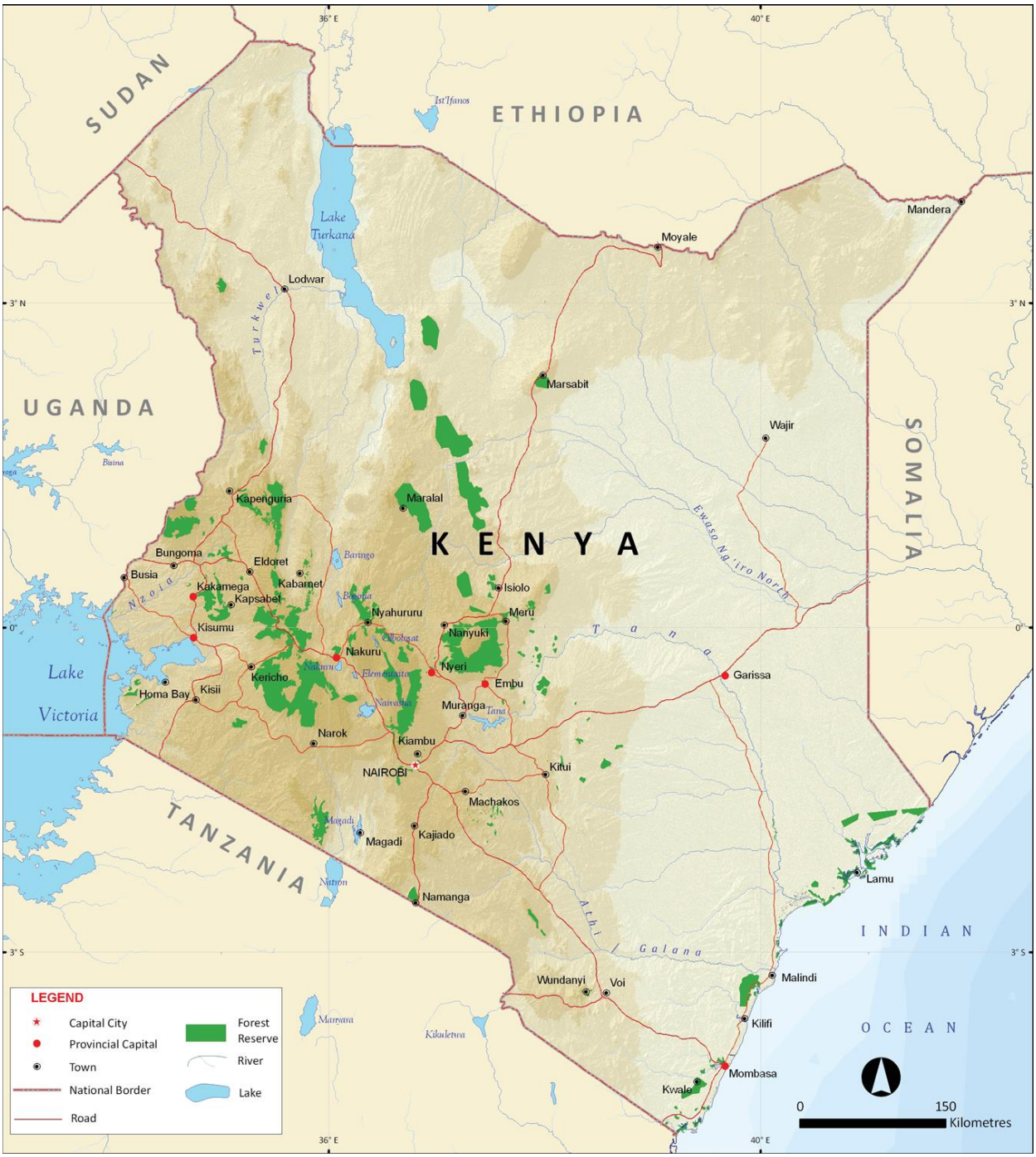

Figure 2.1 Forest Reserves in Kenya

Source: UNEP (2012)

The Kenyan forest sector has over the years developed into an important entity that contributes to the growth of the national economy. For example, a collaborative study by the Kenyan government and UNEP revealed that the value of the production of forest products is estimated at around 3.6% of the country's GDP, versus the 1.1% listed in previous Kenyan national accounts (UNEP, 2012).

2.3.2 Historical Forest Use

Mwangi (1998) states that modern forest management in Kenya officially began when the country was declared a British protectorate in 1895. Prior to the onset of colonialism (pre-1985), locals managed their own forests through rules and systems that defined access to and utilization of forest resources. Many of these systems involved the use of forests for religious purposes with certain areas being deemed sacred and set aside for ancestral worship. For most communities, the rules were enforced by a council of elders, who through sanctions and fines ensured the sustainable use of communal tree and forest resources.

During the colonial period (1895 to 1962) the objective was to "protect forests from destructive indigenous land use practices, to prevent European settlers from obtaining private ownership, and to generate revenue for the forest department through the sale of timber and minor forest products" (Mwangi, 1998). Forest management was highly centralized during this period as is still mostly the case today. Centralization was in the form of the consolidation and concentration of control of forest resources within the forest department through restricting entry, defining what were considered offences, fines and penalties to be charged for offences, the setting up of administrative enforcement through forest guards, and the creation of a forestry advisory committee. A cabinet minister was given sole responsibility for forest management thereby cementing the idea of forestry management as a centralized, national entity. On the other hand, this centralized system acted as a basis of planned forest use as well as for a national forestry administration.

After independence in 1963, the legal framework for forest management in Kenya was provided by the Forest Act of the Laws of Kenya of 1942. The Act was a legacy from the colonial administration that maintained the objectives of reservation, protection, centralization and control of forest management within government. The Act was criticized for being "purely procedural" (Mwangi, 1998), with no provisions for standards or principles along which forest management

could be modeled. During this period, environmental impact assessments were not carried out and there was inadequate consultation between the forest department and forest communities or communities that lived around forest areas. Besides reservation, restriction and prohibition, its other purpose was the sustained production of timber through industrial forestry specifically to increase the production of industrial round wood as a raw material base for a domestic forest industry.

Kenya was the first country in Sub-Saharan Africa to receive a structural adjustment loan from the World Bank in 1980. The government at the time decided to adopt structural adjustment policies as a condition for receiving funding from the World Bank and the IMF. This was necessitated by the effects of the 1973/74 oil shock as well as economic problems resulting from irresponsible financial management. The World Bank has since then been involved in the Kenyan forest sector for almost 30 years mainly in the form of project lending. The forest policy reforms emphasized by the Bank largely focused on promoting efficiency in industrial forestry through expanding industrial plantations and strengthening the capacity of forestry institutions. "According to Forest Department officials, the World Bank's approach to the forest sector was influenced by the structural adjustment programs underway at the time, and thus focused on privatization of public enterprises and reduced government expenditure" (Seymour et al.). Some scholars have noted that increased deforestation was one of the main consequences of structural adjustment policies due to the land-use changes brought about by higher interest rates and a shift of price incentives towards goods for trade (Ahmed & Lipton, 1997). Problems associated with deforestation included loss of plant and animal habitat, the loss of species diversity, and soil erosion. There was the clearance of land for agricultural expansion, and the felling of trees for fuel wood, and for exports. In Kenya, large cutbacks in the expenditure of the Forestry Department reduced the capacity of the organisation to manage the forestry sector to meet the requirements of an environmentally sound and efficient sector (Richardson, 1996).

This period (the 1980s) therefore saw the creation of Sessional paper no. 1 of 1986 which focused on economic management for renewed growth. It defined a broad strategy and specific measures to achieve a targeted GDP growth of 5.6% by 2000 and formed the framework for the country's future development plans. Agriculture was identified as the key sector for economic growth with emphasis on coffee, tea, wheat and horticulture farming. The implication on forestry was clear.

Expanding agricultural production meant sacrificing forests. This period saw the steady decline in the strength of the Forest Department as a public body responsible for the management of forest plantations.

Some of the reasons behind this were a lack of political support and inadequate budgetary allocations. The results of these problems could be seen clearly in supply and demand projections for forest products according to the Kenya Forestry Master Plan (KFMP) of 1994. It was estimated that "future increases in wood supply will not be able to keep pace with the projected increase in demand beyond the year 2000. Furthermore, the total national deficit in wood products was projected to rise to 997,000 m3 by 2005 and 6,841,000 m3 by 2020".

2.3.3 Forest Ownership and Protection

The following are the key institutions engaged in forest and biodiversity conservation and management in Kenya.

The *Ministry of Forestry and Wildlife* serves as the parent ministry for the Kenya Forest Service (KFS), the Kenya Forestry Research Institute (KEFRI) and Kenya Wildlife Service (KWS). It is responsible for implementing policies affecting forests and wildlife and for overseeing forest management, reforestation, and agroforestry. It is also responsible for conservation of water catchment areas.

- The Kenya Forest Service (KFS) was established in 2007 (under the Forest Act of 2005) with the mandate to conserve, develop, and sustainably manage forest resources for Kenya's social and economic development. KFS is responsible for the approximately 1.7 million ha that are gazetted as forests, including montane forests (e.g., Mt. Kenya and the Aberdares), tropical rainforest (Kakamega), dryland forests (e.g., Matthews Range), and coastal forests (e.g., Arabuko-Sokoke). The Forest Act also provided for the development of tourism as a way of adding value to forests and supporting forest conservation. Many plans are currently being made for the development of tourist infrastructure in forest reserves, including lodges, campsites, nature trails, and canopy walkways (KFS, 2012).
- The Kenya Wildlife Service (KWS) was created in 1989 as a state corporation with an overall mandate to conserve and manage wildlife, with sole jurisdiction over national parks

and supervisory responsibility for most of the national reserves, community and private conservancies, and sanctuaries. KWS is the designated national authority for a number of environmental conventions and protocols to which Kenya is a signatory. Since it is authorized to license, control, and regulate all wildlife conservation and management outside of protected areas therefore, KWS is responsible for the management and protection of critical water catchment areas and shares responsibility with other stakeholders in the restoration of the Mau Forest Complex (which is the largest indigenous montane forest in East Africa and one of the country's major water catchment for rivers that contribute towards agriculture, hydropower, tourism, water supply and wildlife habitat throughout much of the country). Outside gazetted forest reserves, KWS has the responsibility for conserving biodiversity.

- The Kenya Forestry Research Institute (KEFRI) was established in 1986 under the Science and Technology Act. KEFRI is entrusted with conducting forest research. It is an autonomous state corporation under the Ministry.

Two other agencies are important. The *National Environment Management Authority (NEMA)*, was established in 2002 as the main agency for the implementation of all policies related to the environment. NEMA has a number of functions, the main one being coordination of environmental management activities of all other agencies. Other main responsibilities include education and public awareness on environmental issues, advice and technical support to other agencies and preparation of an annual report on the State of the Environment in Kenya. The *Ministry of Environment and Mineral Resources* has a mission to promote, monitor, conserve, protect and sustainably manage the environment and mineral resources. It is responsible for policy formulation, analysis and review, and the oversight of NEMA.

As can be seen above (and the list is not exhaustive), Kenya has a significant number of institutions and departments dealing with environmental matters (more than 20). In addition to these, there are numerous NGOs engaged in environmental related activities in the country. Despite the presence of such institutional infrastructure, the country continues to experience environmental degradation and destruction. Lack of institutional linkages, human capital, adequate infrastructure, and sufficient legal authority and political autonomy; have been identified as some of the reasons behind this phenomenon (World Bank, 2007).

2.3.4 Forest Production

It has been stated that "the contribution of forestry to the Kenyan economy is currently undervalued in terms of GDP contribution" (GoK, 2008c). This has been blamed on issues such as carrying out of inventory in protected forest areas only and on an ad hoc basis while disregarding other areas. This isn't exactly a surprise since the total environmental accounting for all goods and services provided by forest ecosystems continues to draw debate worldwide. Though in short supply, sawn timber is a highly valued commodity in Kenya. Reasons for this include limited land for forestry in medium to high potential agro-ecological zones as a result of competition with agricultural production. Forests act as a source for posts used in construction as well as poles for fencing and power transmission.

Rising costs of petroleum-based fuel and high electricity tariffs have resulted in most of Kenya's population relying on wood fuel as the primary source of energy, which encourages further destruction of forests and woodlands. Charcoal production and trade have thus become a critical part of the economy in the country's drylands, providing domestic energy for 82% of urban and 34% of rural households. This industry represents an estimated annual value of over US $427 million (Ksh. 32 billion). It employs over 700 000 people and indirectly supports over 2.8 million people (KFS, 2010).

Forests also play an important role in water catchment, especially in a country like Kenya that is characterized as a water scarce country. They provide water for intensive agriculture through irrigation, urban settlements, industrial processes as well as hydropower plants that traditionally produce most of Kenya's electricity output (UNEP, 2009).

Forests also produce non-timber products such as food and pharmaceutical raw materials mostly derived from woodlands. Essential oils, gums, resins, herbal medicines, silk, and honey, are among other commodities derived from the sector although their value has not been comprehensively assessed. Inhabitants of the dry lands rely heavily on non-timber forest products with about 90% of the medicines they use being herbal-based. In arid areas, gums and resins are harvested from various trees and are a source of income.

The wood carvings industry also earns an average of US$ 20-25 million annually in export revenue from carvings bought by tourists. The preferred indigenous tree species used for carving have already been exhausted in many of the original forests and there have been initiatives to move onto more sustainable sources (CBK, 2009). These include fast-growing tree species that can be introduced on farms. Wood carving is listed as one of the threats facing conservation of the Chyulu Hills ecosystem (KFWG, 2011).

Kenya's tourism sector which is a major foreign currency earner benefits greatly from forests which are habitats for wildlife. Montane forests supply water to major tourist destinations, for example, biodiversity sanctuaries such as Lake Nakuru National Park which depends on the Molo River and the Maasai Mara National Reserve which hosts the Mara River. Both rivers originate from the Mau Forest Complex (CBK, 2009). Forests also host a number of conservation areas that provide a diversity of flora and fauna and closed canopy forests which are major habitats for a large percentage of the country's wildlife and other biodiversity. They contain 50% of the country's tree species and it is estimated that they harbour 40% of large mammal, 30% of bird and 35% of the nation's butterfly species. Kenya's forests also provide great potential for ecotourism which has been shown to support poverty reduction because it involves local communities in enterprise management and monetary benefit sharing.

Forests, therefore, play a significant role in the country, however, their destruction and degradation undermine prospects for long-term economic and socio-political development. SFM with a focus on adaptation to the effects of climate change is one way to ensure destruction and degradation are slowed down.

2.4 Sustainable Forest Management (SFM) in Kenya

2.4.1 Governmental Policy Outputs for Sustainable Forest Management

As previously noted, legislation relating to forest conservation in Kenya can be traced back to the proclamations of the colonial government at the turn of the last century that guided conservation practice until Kenya`s independence. Acts of Parliament and accompanying regulations thereafter governed forestry and wildlife conservation and management, creating national parks, national reserves, and forest reserves. This is the background against which Kenya's policies, laws, and

institutions that deal with forests and biodiversity have evolved. A common feature of the many laws and institutions related to natural resource management (notably wildlife, forests, fisheries, and the environment in general) has traditionally been their state-centeredness and preoccupation with the utilization of resources for economic development.

1.4.1.1.Policies and Laws

Kenya's first forest policy was formulated in 1957 and, after some revisions, was published as Sessional Paper No.1 of 1968. It bestowed significant powers relating to ownership of, and access to, forest resources to the minister responsible for natural resources. ``The Forests Act (Cap 385, revised 1962, 1982) lacked mechanisms for public approval and redress in its judicial and administrative procedures. It gave no room for collaborative forest management and did not take the lifestyles of forest-dwelling communities into consideration. It continued many provisions of the 1957 policy that concentrated on the watershed and timber production functions of forests`` (Mbuvi et.al, 2007)

Until the enactment of the Forest Law in 2005, Kenya's forestry was guided by the 1968 policy and the Forests Act (CAP 385, 1962 and its 1982 and 1992 revisions), which were critiqued for being weak in their ability to protect land designated as forest reserves. CAP 385 empowered the Minister to alter forest boundaries and even to degazette forest reserves. Weaknesses in the law created room for politically motivated excisions, causing further deforestation (Mbugua, 2006). The 1994 Kenya Forest Master Plan was an improvement on previous policy documents and recommended a shift from an exclusionist to a more participatory approach to forest management. The Plan sought to address the problems of poor governance, policy failure, low institutional capacity, inadequate community participation, and corruption in the forest sector.

The Forest Policy of 2005 sought to address the threats to Kenya's forests by promoting participatory approaches to forest management. It facilitated the formation of Community Forest Associations (CFAs), giving local people user rights and security of tenure in order to encourage investment in better farming practices. The policy also emphasized the aspiration to increase Kenya's forest cover to an internationally recommended level of 10%. The Act established the Kenya Forest Service (KFS) as a successor to the Forest Department. KFS formally came into existence in 2007, after the Act entered into force. The Act encouraged participatory forest

management and the formation of Forest Conservation Committees (FCC) to advise the KFS Board on matters relating to management and conservation of forests and each forest conservancy. It also opened up commercial plantations to lease arrangements when the KFS Board 'is satisfied that all or part of a state forest which is a plantation forest may be efficiently managed through a license, concession, contract or joint agreement."

This Act was seen by many as a paradigm shift in forest management especially since unlike other policies before, it claimed to uphold the principles of community participation in natural resource management. Thus, the creation of KFS and the REDD+ Strategy process are seen to be positive achievements and present an opportunity to move the forest sector towards better and more effective governance. But, equally, vested interests in the *status quo* remain and act as a factor to slow down the process.

The following have been identified as challenges facing SFM in Kenya:

- Transparency and accountability – This relates to information on forest resources, use and revenue streams available both internally within the KFS and externally to the wider public. The former Forest Department that was previously charged with managing the country's forests faced many allegations of corruption and mismanagement of the forest resources.
- Participatory Forest Management (PFM) – The need for the promotion of active participation by local communities in forest management with clear guidelines on the definition of community forest associations' responsibilities and contributions has been identified as a challenge.
- Quality of forest administration - The creation of KFS was one of the major institutional initiatives of the Forests Act 2005 to move the sector reform process forward. A study by INDUFOR (2011) alleges that "the role of KFS vs. other actors in the management of the forest resources remains still somewhat ambiguous and some current and/or envisaged tasks may need rethinking given the financial burden they present to KFS. The composition of the KFS Board has also raised concerns regarding potential conflicts of interest and unbalanced representation of the main groups of stakeholders".
- The challenge of availability of sufficient data and information to allow for the preparation of the requisite management plans in a timely manner.

- There has been a challenge when it comes to the issue of updating national inventories, particularly on forest areas, growth and yield as the basis for determining allowable and clear modalities for executing the lease/contractual agreements; and piloting on alternative systems for plantation establishment.

- Challenges surrounding the need to legalize and regulate charcoal making businesses as part of the strategy to raise royalties and promote efficiency in charcoal production.

- The need for more incentives for farm and private forestry which are seen as offering the greatest opportunity for getting Kenya closer to the international standard of 10% of forest cover.

2.4.2 Impacts of Climate Change on SFM in Kenya

Climate change will impact different environments differently, depending on factors such as location and time horizon (Johnston et al, 2010). Most scholars agree that making precise predictions about impacts is a hard task, especially when predicting long-term effects of climate change; however, it is possible to predict how climate change may affect the forest sectors of different locations/countries on a broad level, therefore, helping in determining crucial implications for forest management.

Climate change is currently affecting or will have future impacts on the following components and values related to the forest sector:

1. Forest productivity and management - timber supply and revenues, planning, operations and the ability to achieve objectives;

2. Forest industry profitability - the ability to earn a competitive return on investment;

3. Forest-based communities - jobs, income, social well-being, social and cultural ties to surrounding forest landscapes; and

4. Supply of forest-based public goods and services to the general society - wildlife habitat, special places, clean air and water, productive soils, biodiversity, recreation and tourism opportunities, and aesthetics.

Africa as a whole contributes only 918.49 million metric tons of carbon dioxide per year (less than 4% of the world's total) as compared to the United States which generates about 5.7 billion metric tons (approximately 23% of the world's total, which makes it the leading producer). This is a small amount in comparison yet it is one of the regions most vulnerable to the adverse impacts of climate change (Fields 2005). This high level of vulnerability can be attributed to factors that such as poverty, weak institutions, poor infrastructure, lack of information, poor access to financial resources, armed conflicts, poor governance as well as the lack of or inadequate policies to respond to the impacts of climate change. Many African countries are also situated in latitudes where extremes of climate variation such as drought and unpredictable rainfall patterns, coupled with famine and related humanitarian disasters, are already being experienced. Climate change is expected to add to these extremes, with the poorest communities least equipped to cope (UNEP, 2010).

Kenya, like many other countries, is vulnerable to climate change. Vulnerability, in this case, is defined as the "extent to which a natural or social system is susceptible to sustaining damage from climate change" (Mutimba et.al, 2010). A system's vulnerability to climate change is a function of the impacts of climate change on the system (the degree to which a system will respond to a given change in climate, including both positive or negative effects) as well as the system's adaptive capacity (the degree to which the system is able to adapt to the impacts of climate change). Following this definition, this section examines the impacts of climate change on Kenya's major sectors, particularly its forest ecosystems and the country's vulnerability to climate change.

Kenya is a natural resource and agriculture based economy. The key economic sectors include agriculture, tourism, livestock, horticulture, fisheries and forest products, all of which are highly vulnerable to climate change. As already noted, agriculture is Kenya's most important activity for rural livelihoods, food, and the national economy (earning about 60% of the country's foreign exchange) as well as providing employment for 80% of the population. Agriculture is generally the first economic sector to be affected by climate extremes through drought which has an

immediate impact on crop output, and also by floods. Already the unpredictability of Kenya's year to year productivity causes substantial problems for poor subsistence farmers. A poorly performing agricultural sector, therefore, puts the country's food security at risk. Kenya has in the recent past reported successive seasons of crop failure, increasing the country's food insecurity.

The country's famine cycles have also reduced from 20 years (1964-1984), to 12 years (1984-1996), to 2 years (2004-2006) and to yearly 2007/2008/2009, necessitating the government's distribution of 528,341 metric tonnes of assorted foodstuffs worth Ksh. 20 billion over the last five years to feed a population of between 3.5 million and 4.5 million people annually. The Ministry of Agriculture's 'Economic Review of 2009' indicated that the production of other major crops like tea, sugarcane and wheat had also declined. This could reduce Kenya's foreign exchange earnings in the long term, considering that a commodity like tea is the country's principal export product. The horticulture industry, which is one of the country's top foreign exchange earners, will also be affected by the impacts of climate change. The industry has greatly contributed to the country's economy, creating employment opportunities, especially in the rural areas. The industry directly employs about 4.5 million people countrywide with another 3.5 million benefiting indirectly through trade and other activities generating over US$ 300 million in foreign exchange earnings from the sale of fruits, vegetables, and flowers (PKF Consulting, 2005). This growth has been largely attributed to good weather, improved crop husbandry, and a favorable horticulture export environment, as well as increased markets for fruits and flowers in Europe; all of which may be affected by climate change.

Studies show that by 2100 there will be more intense rains during the wet seasons with floods becoming more common and severe. The frequency of droughts is likely to be the same as now, but again will be more severe due to rise in overall temperatures. This will reduce crop volumes and diversity and will have an impact on livestock (Norrington-Davies & Thornton, 2011). The 2007 Fourth Assessment Report of the Inter-Governmental Panel on Climate Change15 notes that a 2°C rise globally will result in a sea-level rise of between 69cm and 1m (depending on location) across the world.

The rural poor are the most vulnerable to climate change impacts. They are increasingly faced with displacement, loss of earnings, increased vulnerability to infectious diseases, and the interruption

of access to basic services such as education and health care. Changing agricultural cycles and reduced productivity is most notable in Northern Kenya where food insecurity has been linked to malnutrition and cross-border conflict. Such vulnerability has a high economic cost. A 2009 Kenya study produced by the Stockholm Environmental Institute (SEI), estimated that the costs of climate change in the country could be equivalent to a loss of almost 3% of GDP each year by 2030. For example, drought in 1998-2000 is estimated to have had economic costs of $2.8 billion from loss of crops and livestock, forest fires, damage to fisheries, reduced hydropower generation, reduced industrial production and reduced water supply. Similarly, droughts in 2004 and 2005 affected millions of people and the recent 2009 drought led to major economic costs from restrictions on water and energy.

The continued annual burden of events such as flooding and drought will lead to large economic costs as shown above and will negatively impact Kenya's long-term growth and the achievement of Millennium Development Goals (Stockholm Environment Institute, 2009).

The impact of climate change will affect the growth, composition and regeneration capacity of forests due to attacks by invasive species, altered patterns, duration and amount of precipitation, and extended range of pests and pathogens, that will affect some tree species. "Invasions have already been witnessed with Prosopisjuliflora ('mathenge') taking site dominance of important ecosystems in Baringo, Tana River, Garissa and other semi-arid areas of the country. In addition, excessive growth of some tree species has been observed including the excessive growth of Acacia after the 1997 El-Nino in North-Eastern Province that suppressed the growth of various species that form grasslands for wildlife and livestock" (Mutimba et al. 2010).

There has also been documentation across the country of some tree species in the North Eastern and Coast Provinces, becoming either extinct or whose numbers have tremendously dwindled. In addition, there have been predictions of more frequent and more intense fires due to the projected rise in temperatures and long periods of drought. Forest fires have in the recent past affected Kenya's major forests including the Mt. Kenya Forest with the country over the past 20 years having lost more than 5700 ha of forests per year to forest fires according to estimates (Mutai & Ochola, 2012).

Another factor that will further exacerbate the effects of climate change on the country is Kenya's high population growth rate, with communities in pursuit of land for cultivation, energy, and construction material. This is already putting the country's natural resources under pressure. UNEP estimates that land per citizen will reduce from 9.6 hectares in 1950 to 0.3 hectares per citizen by 2050. UNEP (2011) also notes that "Kenya's high dependence on natural resources, its poverty levels and low capacity to adapt, and the existence of other significant environmental stress make it highly vulnerable to climate change." This high dependency on forest resources makes the country's majority poor the most vulnerable to any climatic changes that will affect the forest resource. Below is a discussion of how climate change is affecting/is expected to affect different areas that touch on SFM in the country.

Rangelands and wildlife resources

Rangelands form nearly 88% of Kenya's land mass. These lands support approximately 34% of the country's population. They also form the largest habitat for wildlife (about 75% of the country's wildlife), one of the country's main tourist attractions. Through tourism, wildlife is one of the country's major foreign exchange earners. However, the capacity for these lands to sustain human and wildlife habitation is gradually declining due to extreme weather events such as intense and prolonged droughts and severe flooding, all linked to climate change. A study released by the International Livestock Research Institute (ILRI) in 2010 has associated widespread and substantial declines in the number of animals in the Maasai Mara (Kenya's world famous game reserve whose great wildebeest migration was named one of the seven wonders of the new world) with climate change.

The majority of pastoralists are poor and their livelihood is climate dependent, their adaptive capacity can be said to be low, making them highly vulnerable to the impacts of climate change. The impacts of climate change on Kenya's rangelands include change in pasture productivity, extremely strong winds and flash floods which result in the eroding and washing away of grass seeds, therefore, inhibiting grass growth. This effect on grasslands results in "loss of habitats for wildlife, carbon dioxide fertilization, leading to higher plant productivity, in particular, the proliferation of invasive species, disruption of natural ecosystems by causing species' ranges to shift altering predator-prey interactions, decoupling animals from food sources or reducing habitat,

and droughts that affect grasslands, causing massive deaths of livestock and wildlife, and an increase in human-human and wildlife-human conflicts" (Mutimba et al. 2010). These cases have been reported in areas around the lower Tana Delta, Laikipia, and Lagdera.

Coastal Mangrove Forests

The Kenyan coastline is characterized by a rich diversity of flora and fauna, including fish, coral reefs, and mangrove forests. Predicted effects of climate change on mangrove forests include both more extreme droughts and flooding. In 1997/8 and 2006, substantial sedimentation following extremely heavy rainfall caused the erosion of mangroves in many areas along the coast. Mwache Creek, a peri-urban mangrove forest in Mombasa was the most affected, losing close to 500 ha of mangrove forest (CORDIO, 2008). This trend is likely to jeopardize the livelihoods of local people depending on the mangroves especially for fisheries, wood products and coastal protection, and temperature changes and further sea-level rise will only accelerate these trends. "This makes the Kenyan coast one of the most vulnerable to sea level rise in the world, with the most vulnerable aspects being developments on low-lying areas including agriculture, infrastructure, and tourism" (Mutimba et al. 2010).

Forest-based Communities

The effects of climate change will not be evenly distributed across Kenyan society. Certain segments of society face higher risks because of their "location, their association with climate-sensitive environments, and their economic, political and cultural characteristics" (Johnston et al. 2010, Williamson et al. 2007). Rural and resource-based communities are of particular concern.

In addition to the general risks and impacts associated with climate change, e.g. potential health effects, impacts on infrastructure, and exposure to extreme weather events; forest-based communities also face additional factors that add to their overall vulnerability. These include:

- Strong ties to their surrounding climate-sensitive environment,
- Increased risks owing to the expected increases in forest fires,
- Potential changes in local wood supply.

These will have significant impacts on local economies, particularly those that are heavily dependent on forest products. Davidson et al. (2003) identified five socio-economic factors that further contribute to the heightened levels of vulnerability of Canadian forest-based communities. These can be extrapolated to forest-based communities in many regions and are issues faced by these communities in Kenya as well.

They include:

- Adaptive capacity constraints (e.g. small and undiversified economies and overspecialized local labour forces with skill sets that are not transferable to other sectors),
- Potential for larger scale institutional responses to environmental issues and climate change that ultimately affect small, rural, resource-based communities,
- Lack of consideration of climate change in forest management decisions and forestry institutions that may ultimately lead to higher impacts manifesting at the community level,
- Potential misperception of the risks of climate change, and
- An increase in multiple, simultaneously occurring and interacting risks (e.g. climate change plus market downturns).

In summary, the combined effects of higher potential risks and lower adaptive capacity mean that forest-based communities tend to be more vulnerable to climate change than other types of communities.

2.5 Conclusion

Climate change will definitely have an impact on the ability to achieve the objectives of SFM in Kenya. It will affect the long-term ability of forested ecosystems to maintain ecological functions and processes. The forest sector will "need some fundamentally new approaches to address this issue" (Hamann & Wang, 2006). However, as this chapter has shown, Kenya faces a number of challenges common to many developing countries. These include the legacies of the colonial forest

administration, fragmented institutions, complex policy frameworks and implementation deficits. Faced with these kinds of challenges, it is a struggle to decide whether to reform the centre, bypass central institutions altogether and work with communities directly or devise some more productive relationship between the two. The next chapter discusses the broader question of environmental governance in developing countries and the implications for SFM.

CHAPTER THREE

ENVIRONMENTAL GOVERNANCE AND ALTERNATIVE APPROACHES TO TOP-DOWN FOREST GOVERNANCE

Environmental governance is defined as a "way of achieving better environmental management through the role-taking of diverse actors, such as national governments, local governments, companies, NGO, international institutions, scholars, and mass media" (Nakazawa, 2006). Castro (2001) notes that the state is frequently the entity that manages forest reserves, parks and protected areas with a lot of political and personal interests involved.

As noted in the previous chapter, in Kenya, the locus of power historically lay with the central government, leaving local communities with little or in some instances no input in the governance system. The Forest Department managed and controlled all forests in the country with the central focus being conservation. After the country's independence in 1963, a series of donor funded forestry programs focused on afforestation and reforestation on farms, the goal being the alleviation of fuelwood shortages. The 1980s saw an increase in frictions between communities who needed fuelwood from neighbouring forests, and the forest department (Ongugo & Njuguna, 2004). Coleman & Fleischman (2011) note that "broad decentralization began in 1983 with the establishment of the District Focus for Rural Development system, which delegated responsibility for numerous rural development projects to the local districts. However, policymaking, planning, and funding decisions largely remained centralized within government ministries. Local districts (and their associated county councils) had limited accountability to local people, and decision-making in the forest sector rested exclusively with the forest agency".

This has been an ongoing challenge in Kenya's forest management and has seen policy recommendations put forth in an attempt to solve this e.g. the Forest Act of 2005. The Act called for the formation of the Kenya Forest Service (KFS), a semi-autonomous government agency

comprised of representation from various government ministries with the expectation that this would facilitate the devolvement of power to the private sector and to forest conservation committees and community forest associations (CFAs). The new policy aims to promote community participation, achieved primarily through CFAs, and the integrated management of forests (Ongugo et al. 2008).

In their comparative study of forest decentralization in Kenya, Coleman & Fleischman (2011) note that in terms of upward accountability, "we have less confidence in our expectations of the Kenyan reforms. The law was passed in 2005, stipulating the creation of CFAs, but their role remains to be seen. It does seem that the central government maintains much control over the decentralization process". They are however optimistic that since decentralization reform in Kenya saw the creation of new policies that did not exist in the past, for example, property rights; there is a likelihood of stakeholders wanting to test the meaning and limits of these new rights by establishing new rules. These new rules could be in the form on different forms of engagement and interactions amongst the different stakeholders for example through adaptive collaborative management.

3.1 Decentralization in Kenya

The development of national environmental policy is essentially a political process. As mentioned, decentralization of forest management has gained popularity in developing countries in the recent years (Agrawal, Chhatre and Hardin 2008), with the view that it can be a means of enhancing economic efficiency, public accountability, community and individual empowerment, and allocative efficiency in the forest sub-sector (World Bank, 2009). These reforms are expected to reconcile conservation and livelihood needs. In particular, forest decentralization is aimed at enhancing peoples' livelihoods, poverty alleviation, and preservation of forests.

A number of Community Forest Associations (CFA) have been formed through sensitization of communities adjacent to the major forests in the country by the Kenya Forest Action Network (KFAN) and the Kenya Forests Working Group (KFWG) (Ongugo et al., 2007). The Kenya Forest Service has also been spearheading the formation of CFAs as a step towards meeting the requirements of the Forest Act.

Although the legal regime for Community-Based Natural Resource Management (CBNRM) can be seen as progressive, a major challenge has been in implementation. In Kenya, it remains vague on pertinent aspects of community involvement, including the extent of community rights, powers, and benefits in relation to those of other stakeholders.

The socio-political context of the national recovery after the 2008 post-election disturbances also had a considerable impact on both national actions and on the positions adopted by development partners. The years after saw considerable resources being diverted away from the challenges of long-term development. Any resolution process was and still is highly political. At the sub-national level, political differences and lack of agreement over key environmental issues remain apparent, as in the highly polarized situation over the rehabilitation of the Mau forest (Soi, 2015).

Despite this, environmental management is one of the themes addressed under the social pillar of the Vision 2030 strategy, the Government's long-term development blueprint, launched in 2008. However, as Vision 2030 states, the institutional arrangements for addressing environmental issues are not robust at present: "Kenya's current institutional framework to manage the environment is characterised by fragmentation. Various aspects of environmental policy cut across different institutions. Although the Environment Management and Coordination Act of 1999 was a major landmark, with the primary objective of improving coordination and management of the environment, legislation of relevant laws and regulations have not yet been completed" (Vision 2030, p. 104).

Four strategic areas for government action were identified to help realise the national vision for the environmental sector. These are:

i. Conservation of natural resources,
ii. Pollution and waste management,
iii. High-risk disaster zone management and,
iv. Environmental planning and governance.

Four 'flagship' projects were also identified to be undertaken as priority actions:

i. Water catchment management

ii. Secure wildlife migratory routes
iii. Develop a national waste management system
iv. Land cover and land-use mapping.

The list above clearly demonstrates that Kenyan forest policy lacks integration with interacting policies such as climate policy and that integration between forest management policy and interacting policies needs to be strengthened if SFM goals are to be achieved.

3.2 Alternatives to the Top-Down/Centralized Approach to Forest Management

Fisher, Rabhu & McDougall (2007) assert that "the easy solutions offered by centralized resource management no longer work, and the era of top-down decision making is all but over". New approaches that have been proposed in place of the top-down approach include learning-based approaches, using a wider range of knowledge (including local and indigenous knowledge), dealing with uncertainty and complexity, and the sharing of management power and responsibility. Resource management has become an ongoing learning and collaboration process for shared problem solving, and not just a focus on a search for the "optimal solution" (Fisher, Rabhu & McDougall, 2007).

As discussed above, complete centralization of forest management in Kenya has had negative results while decentralization has brought about mixed results. There is clearly a need for new methods of engagement with regard to achieving the objectives of sustainable forest management. One of these ways could be through adaptive collaborative management (ACM).

3.2.1 Adaptive Collaborative Management (ACM)

Adaptive management is described as a way of dealing with uncertainty and complexity; while collaborative management is about sharing management power and responsibility. Both are seen to be evolving towards a common ground. "Adaptive management, without user collaboration, would become a sterile technocratic process; collaborative management, without a learning loop, eventually withers" (CIFOR, 2012). It is generally acknowledged that forest management in a rapidly changing world requires a process of deliberate social learning and collaborative problem-solving, therefore, the development of flexible and participatory governance systems that can learn from experience and generate knowledge to cope with change is seen as an important mechanism

for adaptation and resilience in a world characterized by unpredictable shocks and stresses. Collaboration in generating options, thus contributing towards building resilience in linked systems of forests and people.

CIFOR (2012) describes adaptive collaborative management (ACM) as an engine for adaptation and innovation. "It is a quality-adding approach to forest management and governance, whereby stakeholders - the people or groups who use, control or in some way have interests in a forest - engage in a process of effective social interaction in which they negotiate a vision for the forest. The actors consciously undertake deliberate and shared learning in developing and implementing their plans for their forests. In doing so, they jointly observe and reflect on the outcomes of plans - especially the unexpected - and the process of planning, and together, they then continually seek and negotiate innovations and improvements in understanding plans, processes and implementation". In short, ACM is based on the idea that management and governance are rooted in a process of intentional learning by a group of people dealing with a shared area of concern, with the intention of innovating for improvement or to achieve their goals and objectives.

The ACM approach can be viewed as encompassing three pillars:

1. Communication and creation of a shared vision - ACM stresses the importance of a vision in forest management. Holland (1998) points out that innovation is unlikely to result when actors simply gather more facts and incrementally revise hypotheses. Instead, it usually requires the selection of a goal in the beginning. "In ACM, the vision is not a fixed point to be achieved. Rather, the vision serves as a reference point for forest actors as they navigate their way through decision making and actions in management and governance, it is closely related to reflection and self-monitoring. Communication is critical in ACM, not only for enabling the shared vision to emerge but also because effective communication is the foundation for creating a whole that is greater than the sum of its parts" (2007). Effective communication brings together diverse stakeholders to share their worldviews, goals, values and knowledge.
2. Learning among stakeholders - Learning among stakeholders in ACM requires that those involved seek and apply knowledge actively and deliberately, as opposed to incidentally or passively. It also requires that the action taken is agreed upon and supported by the

actors involved. This need for joint or collective action reflects the complex nature of forests, people's overlapping interests, rights and responsibilities, and the resulting potential for tensions between local, meso and national levels of governance as well as between private, government and civil society institutions. Even within one local area, the common property nature of community forests demands that if actions are to be acceptable to most forest actors, they will need to be jointly agreed on, if not jointly carried out.

3. Joint or collective action – The basis of joint or collective action and the governance and management processes as a whole requires the finding and the coming together of the 'right' actors which is a challenge because the definition of the right actors is subjective as well as time, context and issue dependent. Wollenberg et al. (2007) identify problems associated with collective action, for example, relating to transaction costs in achieving them which may in some cases outweigh their immediate gains. They also point out that the more powerful members of a group tend to take over and control such agreements.

The three anchors described above can be further elaborated as seven elements (Fisher et al., 2007):

1. All relevant stakeholders are involved in decision making and negotiation and have the 'space' and *capacity* to make themselves heard.

2. Stakeholders effectively communicate and transfer knowledge and skills (in multiple directions).

3. Stakeholders implement actions together, as appropriate.

4. Stakeholders seek to effectively manage conflict.

5. There is shared intentional (i.e., social) learning and experimentation in the forest management process, and this learning is consciously applied as the basis for refinements in community forestry management activities and processes.

6. Planning and decision making include attention to relationships within and between human and natural systems.

7. Planning and decision making clearly reflect links to the 'desired future' and consider current trends and the inevitability of surprise and uncertainty.

ACM calls for a shift by government and NGO service providers from the top-down approach of direct planning and decision making in local forest management. "Instead, these outside experts become collaborators and co-learners who contribute to the local processes and plans in response to the needs of local actors. They may take leadership roles in facilitating meetings and catalysing ACM, but leadership is also, and most importantly, drawn and developed from within local communities themselves. The facilitators, whether insiders or outsiders, help to link perspectives, goals, and knowledge from different sources and engender a learning orientation in the management processes and plans" (2007). ACM also recognizes the limits of each stakeholder's understanding of natural systems and accepts that change and variation are characteristic of ecosystems. To that extent, it is a potential solution to the challenges of adapting SFM principles to the emerging realities of climate change in forest ecosystems. Adaptive management enables managers to proceed without resolving all uncertainties in advance, while explicitly recognizing change and variability. It is a management approach that involves conscious learning based on action and the observed consequences of action. However, there are divergent views on which actors should take the lead in adaptive forest management. While the debate is a complex one that takes place in the context of the multilevel governance of forests in most parts of the world, part of the disagreement revolves around the development of the appropriate capacities for adaptive management. As is clear from much of the literature on ACM, some believe that these capacities need to be developed at the local level, where those whose livelihoods depend on forest health make day to day decisions. At the very least, on this view, local communities need to be actively engaged in decisions about forest use. Active engagement will build on local knowledge and translate into the confidence to manage local resources responsibly.

On the other side, the problem is seen as a traditional administrative one of addressing an implementation deficit. The capacity to develop an evidence-based policy framework is, on this view, necessarily something that only national or well-resourced sub-national governments will possess. Local communities may usefully be engaged as partners in implementing centrally devised policies, including policies designed to allow for adaptive management in the face of climate change, but "collaboration" in the broader sense is not just unnecessary but counterproductive. Local successes and failures need to be properly evaluated and incorporated into future policy design but these are further features that require strong central policy capacity.

This thesis does not attempt to mediate between these two points of view. Noting the common ground around the need for capacity, in the next chapter, I note that capacity is a complex and difficult concept to clarify and operationalize. Defining and operationalizing central government capacity is in many ways an easier task than doing the same for local capacity. I develop an index of central policy capacity and combine it with conventional indices of environmental vulnerability based on biophysical components to obtain a consistent ranking of developing countries overall vulnerability to environmental issues such as climate change.

Conclusion

In a world of rapid transformations and uncertainty that includes global climate change, building the capacity of countries to adapt to this change will be a prerequisite for sustainability. Systems of collective decision-making whether at the central or local levels, are critical components of capacity for adaptation. Planned anticipatory adaptation has the potential to reduce vulnerability to climate change, regardless of where adaptation takes place. The capacity to adapt varies among regions, countries, and socioeconomic groups and will vary over time with the most vulnerable regions and communities being those that are highly exposed to climate change effects and have limited adaptive capacity (Smit and Pilifosova, 2001). Countries with limited economic resources, low levels of technology, poor information and skills, poor infrastructure, unstable or weak institutions, and inequitable empowerment and access to resources have little capacity to adapt and may be highly vulnerable, therefore, the task of building adaptive capacity is particularly urgent for developing countries such as Kenya.

Adaptive collaborative management in Kenya will be a vital component in building resilience and the capacity to adapt to environmental challenges such as climate change. Building adaptive capacity is systemic and this means that it involves establishing institutional linkages that promote an institutional environment in which the various levels of institutions are linked, inclusivity in decision-making at these various levels, and as well as deliberation. These features can work together to create meaningful multi-level participation to facilitate the co-production of knowledge and to build adaptive capacity.

CHAPTER FOUR

POLICY CAPACITY AND ITS INFLUENCE ON COUNTRIES' ADAPTIVE CAPACITY TO CLIMATE CHANGE

4.1 Adaptive Capacity

The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has put forth clear evidence of the occurrence of climate change and its impacts on achieving environmental management goals such as SFM. Countries are, and will continue to be affected by and need to adapt to these impacts. The IPCC points out that many developing countries are particularly vulnerable because of their relatively low *adaptive capacity*.

Johnston et al. (2012) define adaptive capacity as the ability of a natural or human system to adapt to the impacts of climate change, while Brooks (2003) defines it as the ability of a system to adjust, modify or change its characteristics or actions to moderate potential damage, take advantage of opportunities or cope with the consequences of shock or stress. "A key component of this is ensuring that individuals, communities, and societies are actively involved in processes of change" (Pettengell, 2010). This relates to changes in behavior, resources, and technologies.

Understanding adaptive capacity, therefore, entails recognizing the importance of various intangible processes such as decision-making and governance; the fostering of innovation, experimentation, and opportunity exploitation; and the structure of institutions and entitlements. "Doing this requires moving away from simply looking at what a system has that enables it to adapt, to recognizing what a system does to enable it to adapt" (WRI, 2009).

Smit and Wandel (2006) point out that adaptive capacity is context-specific and varies from country to country, community to community, among social groups and individuals, and over time. "The scales of adaptive capacity are not independent or separate: the capacity of a household to cope with climate risks depends to some degree on the enabling environment of the community,

and the adaptive capacity of the community is reflective of the resources and processes of the region".

Lemos et al. (2007) are of the view that adaptive capacity can be created by: "(1) investing in information and knowledge, both in their production and in the means of distributing and communicating them; (2) encouraging appropriate institutions that permit evolutionary change and learning to be incorporated; and (3) increasing the level of resources such as income and education to those in which they are presently lacking". Folke (2003) identified four general factors that may foster adaptive capacity in social-ecological systems, particularly during periods of crisis:

1. Learning to live with change and uncertainty;
2. Nurturing diversity for resilience;
3. Combining different types of knowledge for learning; and
4. Creating opportunity for self-organization toward social–ecological sustainability.

"Adaptive capacity, therefore, provides a valuable analytic construct around which managers, scientists, resource users, and policy makers can come together in theoretically engaged but decidedly applied ways to address the challenges of governance" (Plummer & Armitage, 2010).

In sum, adaptive capacity refers to the ability of any system to handle or deal with disturbance and respond to change, and is impacted by the enabling environment's resources and processes.

4.1.1 Measuring Adaptive Capacity

Jones, Ludi & Levine (2010) point out that directly measuring and assessing adaptive capacity is a challenge. Estimating capacity calls for identifying the characteristics or features that influence it. However, there is no agreement about what these characteristics and determinants are at the national, community or household level. The Intergovernmental Panel on Climate Change (IPCC) identifies economic wealth, technology, information and skills, infrastructure, institutions and equity as the principal determinants of adaptive capacity (IPCC, 2001), although no distinction is made between determinants at the national and local level. Recent assessments claim that social factors, in particular, power relations for example social capital, governance structures and the role and functions of institutions, have been underplayed in earlier studies (IPCC, 2007).

As has been mentioned before, although local stakeholders are key to achieving SFM objectives on the ground, national governments play important roles in establishing effective enabling environments and directing resources and technical support. Ultimately, effective adaptation takes place through the dynamics of local governance, civil society engagement, and economic development building from the actions of local authorities, civil society organizations, and private sector businesses. National governments can help contribute towards higher adaptive capacity by strengthening the knowledge base of climate vulnerability assessments, providing the policy and legal framework for climate risk reduction measures related to land use planning, health, and other sectors and ensuring that infrastructure investments take climate change into account. In other words, we can assume that a country's ability to effectively make decisions and implement them (policy capacity) has an impact on its ability to adapt to environmental challenges. Therefore, a measure of overall policy capacity can be one indicator of a country's adaptive capacity as demonstrated by Johnston et al. (2010) who report that high levels of education and experience among professional forest managers as well as strong institutions (which are components of policy capacity) in Canada, for example, contributed to a relatively high capacity to adapt.

4.2 Policy Capacity

In recent years, there has been interest in improving the policy process through strengthening the *policy capacity* of the public sector (Polidano, 2000; Howlett, 2009). The term policy capacity can be used to refer to the organizational structures, processes, and cultures that support effective policy development and implementation. It includes, among many other factors, the competency of individuals involved in the policy process.

The Canadian government defines policy capacity as follows:

> The policy capacity of government is a loose concept which covers the whole gamut of issues associated with the government's arrangements to review, formulate and implement policies within its jurisdiction. It obviously includes the nature and quality of the resources available for these purposes- whether in the public service of beyond- and the practices and procedures by which these resources are mobilized and used.
>
> (1996)

The following is a list of other definitions emphasizing the different dimensions of policy capacity:

- Olsen (1983) - The ability to use resources in a systematic way to make intelligent collective decisions in a democratic political-administrative system based on sufficient understanding, information, and authority.

- Polidano (2000) - The ability to structure the decision-making process, coordinate it through government, feed informed analysis into it, and ensure that the analysis is taken seriously;

- Davis (2001) - The ability of governments to decide and implement preferred courses of action, which makes a difference to society and its economy;

- Painter & Pierre (2005) - The ability to marshal the necessary resources to make intelligent collective choices about and set strategic directions for the allocation of scarce resources to public ends; and

- Peters (2005) - The ability to make strategic choices to achieve stated goals.

At the core of all these definitions is the ability to make decisions. It can, therefore, be concluded that policy decision-making requires skills and expertise for the effective utilization of knowledge. The focus on making decisions (choices) intelligently points to the quality of workers needed in public service. Aucoin & Bakvis (2005) are of the view that "since policy capacity, first and foremost, is a function of collective intelligence brought to bear on matters of public business, the challenge to securing and maintaining policy capacity is to have the best minds attending to this core set of governance functions. In short, state policy capacity requires a professional public service that contains these minds". This, of course, requires the recruitment of and the ability to retain and develop the "best and brightest" policy workers.

Berg (1993) argues that none of the components of policy capacity is more critical than having public servants with the ability to do "high order" work as has been proven by the continued focus on human resource development as one aspect of capacity building, the others being institutional strengthening and procedural improvements. This is crucial in the context of policy capacity

because the ability of individual public servants to plan, analyze, implement and evaluate policies to address critical issues will have a direct impact on the wellbeing of the citizens in their societies.

Although policy analysis and decision-making capacity are important in SFM, the capacity to implement policy decisions is crucial if the objectives of SFM are to be achieved. As has been mentioned before, Kenya does not seem to have a problem preparing different policy documents to address the various challenges the country faces; the issue is implementation on the ground. Peters (2004) argues that implementation has often been thought of as program administration and is seen as being separate from policy formulation and that there is a need to take implementation into consideration at the policy formulation stage to ensure effective policy. In my study, I will use Polidano's definition of policy capacity as a reference as it includes the element of implementation authority and the capacity to carry that out.

4.2.1 Measuring Public Sector Capacity

The use of numerical indices to measure and differentiate different countries' performance in the social, economic and political spheres is well established. Examples include UNDP's Human Development Index, Transparency International's Corruption Perception Index (which measures the extent of corruption in different countries based on surveys), and the World Bank's 1997 World Development Report (which examines state credibility for different countries in areas such as political stability, investment risk, and quality of governance) etc.

Polidano (2000) developed an index to measure public sector capacity which he defines as "the ability of the permanent administrative machinery of the government to implement policies, deliver services, and provide policy advice to decision makers". The Polidano index seeks to be policy neutral, in that it ideally, seeks to measure public sector capacity "independent of the policies adopted by the government of the day". Emphasis is placed on the permanent administration of the state irrespective of what policies the government in power seeks to pursue i.e. concern is not on the political choices of the leadership of governments.

Polidano argues that "policy changes on their own are not enough to bring about sustained improvements in national competitiveness; and that the policy changes can fail unless attention is paid to the capacity of the institutions that must carry them out". He limits his index to measuring

public sector capacity within the central government and explains the exclusion of private entities such as NGOs especially in developing countries in the index, as an indication of an already weak or inadequate public sector. He identifies these three elements as components of public sector capacity:

- Policy capacity - The ability to structure the decision-making process, coordinate it throughout government, and feed informed analysis into it. An indicator for this component would be the availability of complete country data in international publications. This indicator aims to measure the ability of a government bureaucracy to collect information, a factor that has been extensively identified as a key aspect of policy capacity. An example would be assessments of technical competence or bureaucratic quality such as the International Country Risk Guide (ICRG) conducted by the Political Risk Services (PRS) Group.
- Implementation authority - The ability to carry out decisions and enforce rules, within the public sector itself and the wider society. This is concerned with the implementation of government decisions as well as social compliance with the rules, laws, and regulations of the state. An indicator for this component might include the extent of corruption within the public sector. These are done by various organizations such as the Economist Intelligence Unit, and Transparency International. Other possible indicators might include the amount of revenue tax collected compared to what is owed.

  And thirdly;
- Operational efficiency - Referring to the cost-effectiveness of the internal operations of the public sector and the quality of the services it provides to the public. Indicators for this could include wages and salaries as a percentage of central government expenditure, government spending on various ministries as a percentage of its GDP etc. These indicators measure general efficiency as well as the quality of services provided by the public sector.

The Polidano Index of Public Sector Capacity

Table 4.1 Elements of Public Sector Capacity and their Indicators

Elements	***Indicators***
Policy Capacity	• Information gathering capacity • Staff expertise • Institutional weight in the policy process
Implementation Authority	• Internal compliance (e.g. extent of corruption)
Operational efficiency	• Social compliance in different policy sectors • Cost-efficiency • Quality of service

Contemporary policy capacity research and studies cite Polidano mostly in their definitions of policy capacity and public sector capacity (Gleeson, 2009; Minogue; 2005; Delpeuch & Poulton; 2005 etc.). Gleeson (2009) acknowledges Polidano's emphasis on coordination of the policy making process and coherence across policy areas while Minogue agrees with Polidano's assertion that though crude and often highly subjective, indices from international bodies such as Transparency International, the World Bank, the UN, world competitiveness rankings etc. play important roles in highlighting the relative variations in a given attribute for making systematic comparison.

Polidano's description of policy capacity is most relevant to my study since he also considers the issue of implementation authority, a factor that has been pointed out my scholars as particularly problematic in Kenya's efforts at achieving SFM goals. Below, I discuss Kenya's policy capacity challenges especially with regard to SFM.

4.3 Policy Capacity in Environmental Management in Kenya

The capacities of countries to cope with the challenges of global environmental change vary considerably. Some countries possess more capacity and their environmental policies are more ambitious than others. In Kenya, environmental management is inhibited by weak institutional capacity; lack of interdisciplinary understanding, sectoral integration or functional coordination; failure to involve key stakeholders such as NGOs and local communities; and poor policy implementation in general. Government institutions charged with responsibility for the environment have been reported to have overlapping mandates as well as compete for recognition and resources.

Mogoi et al, (2010) and Kimani (2008) have stated that there is weak capacity in most forest sector agencies in the country noting that the Reducing Emissions from Deforestation and forest Degradation (REDD) Secretariat, for example, lacks adequate staff to enable it to deliver its mandate. They also report that capacity to generate adequate data for management is insufficient in the Kenya Forest Service and other institutions i.e. there is insufficient data on the status of forest resources in terms of quality, quantity and trends on growth and yield as well as investment opportunities in forestry that are required for informed decision making in the overall management of forests. Other institutional capacity gaps identified by the Kenya Forest Service are; insufficient budget provision, poor infrastructure, lack of information and knowledge on Participatory Forest Management (PFM) which is viewed as contributing towards SFM goals, inadequate production and supply of quality development input, and inadequate use of information communication technology (ICT) in forest management and inadequate capacity.

Mogoi et al. (2010) have identified the various challenges faced by government bodies charged with environmental management and to a large extent, SFM. The Kenya Forestry Research Institute (KEFRI) which is a crucial stakeholder in the country's forest governance and management with well-trained scientists and modern facilities still faces challenges such as low funding, poor remuneration of workers, weak capacity to publish and disseminate research findings, weak administration capacities at their regional centres, low capacity in information technology development and inadequate capacity in the management of revenue generation activities. The Kenya Wildlife Service (KWS), another very important stakeholder in the country's

efforts at SFM, also faces challenges such as the use of outdated legislation, poor communication and relations with communities, inadequate vehicles and equipment and limited comprehensive biodiversity inventory in most of the protected wildlife areas including forests in national parks and national reserves (Rotich et al, 2014). The National Museums of Kenya (NMK), another major actor in Kenya's SFM efforts, has strong technical and research capacity, strong international links, well trained and skilled staff, favourable political will and strong research programmes but is however affected by inadequate funding, low staff morale, and inadequate ICT policy technology.

The country's challenges, therefore, are not only to define goals for the long, medium and short-term, but also to organize the political and financial systems and encourage the active participation of the different actors in the society by engaging them in dialogue and action plans. The transfer of knowledge to different members of society through educational channels is necessary for changes to attitude and ultimately behaviour. A greater awareness of, as well as training on, the relevant issues and processes would enable legislators, consumers, and private sector representatives to make and expand the legislation, course offerings, and economic opportunities needed to develop a green economy and improve overall management of the environment including forests. This can only be possible if the various stakeholders have the policy capacity to learn, to engage with each other and to implement policies effectively.

4.5 Conclusion

Given the uncertainty about the impacts of climate change, what is needed is a way of estimating the vulnerability of countries to the impacts of climate change and their capacity to respond by adaptation. In the following chapter, I will use Polidano's Index of Public Sector Capacity (PSC) as a reference in order to measure different countries' policy capacities. The values from the PSC will then be averaged with an environmental index measuring the vulnerability of countries to environmental challenges such as climate change. The scores from this will then be compared to another environmental index that considers both environmental vulnerability and policy capacity in its indicators and this will hopefully help determine whether the two indices can be used interchangeably or if at all the two indices measure the same things, with my attempt (at creating an index) being a simpler way of measuring countries' adaptive capacity. The data will be in comparative form and will derived will be for countries both similar to and different from Kenya.

The rationale for the choice of countries will be explained further in the next chapter. Scores from these indices will also provide evidence for how Kenya compares with the other countries under study, what areas (in relation to adaptive capacity) the country scores poorly in and this will hopefully provide a valuable, analytic construct around which stakeholders involved in sustainable forest management in the country can engage about ways to address the challenges posed by climate change.

CHAPTER FIVE
POLICY CAPACITY AND ITS IMPACTS ON COUNTRIES' ADAPTIVE CAPACITY TO ENVIRONMENTAL VULNERABILITY

Environmental policymaking faces two challenges, both of which can be mitigated through better data (Hsu et.al, 2014). The first challenge is centered on debates about the goals and priorities of environmental policy, which often elicit differences over the best way forward. Secondly, there is the issue of the uncertainty surrounding the nature and severity of environmental problems (e.g. climate change) which then negatively impacts the allocation of resources towards any action. Evidence-based policy debate can contribute towards objectivity, therefore decreasing disagreement on the scope of problems and instead direct focus towards solutions. It also gives policymakers a basis from which to advocate for objective environmental policy or any changes to current policy.

There have been many attempts to address these issues. The Consortium of International Agricultural Research Centers (CGIAR), for example, has developed a framework of indicators to measure capacity development (CGIAR, 2015). This framework is a list of 120 indicators, a high number that may result in challenges in monitoring and evaluation. What is needed is an index that it is simple, manageable and meaningful. The next section of this chapter selects indicators and proposes a methodology for the construction of an index, the Policy Capacity and Adaptability Index (PCA), which is an attempt to follow those principles with a focus on SFM. Using Polidano's Public Sector Capacity (PSC) index as a guide, I created this index to measure the central policy capacity of selected countries. This was then combined and averaged with an environmental vulnerability index to determine whether policy capacity can be mobilized to offset environmental vulnerabilities.

This chapter has five sections. Section 5.1 discusses my selection of countries to investigate; 5.2 explains and shows the construction and results of the PSC; 5.3 shows the construction and results

of a policy and environmental index, what I call the Policy Capacity and Adaptability (PCA) index; Section 5.4 discusses the results and Section 5.5 discusses the lessons that Kenya can learn from similarly situated countries.

5.1 Selection of Countries under study

As already mentioned, each country would receive two separate ratings under the proposed approach: one overall score for public sector capacity, and another score for environmental vulnerability. This section uses a simple methodology to construct each rating from the various indicators i.e. all indicators are scored on a common rating scale of 0 (worst implications for capacity) to 10 (best implications for capacity). This approach is similar to that used by organizations such as Transparency International.

To simplify this data in reference to Kenya, three country groupings will be compared, with Kenya added to the third grouping, the African group, to make it eleven. The first ten country grouping is a list of developed countries that have high scores in all the selected indices excluding the Environmental Vulnerability Index (EVI). These countries were chosen because they represented countries varying in geographic size, demographics in terms of population and population density, ecological and environmental issues, and lastly in terms of forest cover.

Group A - Developed countries

a. Canada
b. The US
c. Netherlands
d. Singapore
e. Japan
f. Sweden
g. Australia
h. United Kingdom (UK)
i. New Zealand
j. Norway

The second grouping was based on two sets of criteria. The first included the BRIC countries (Brazil, Russia, India, and China). These countries and their relative importance are self-explanatory as the most important countries economically and politically during the period of

study. The other 6 were chosen based on relative similarity to Kenya in terms of demographics i.e. population and population density, ecological and environmental issues, levels of development and the global importance of their forests.

Group B - BRIC + 6 countries.

a. Brazil
b. Russia
c. India
d. China
e. Mexico
f. Peru
g. Indonesia
h. Colombia
i. Venezuela
j. Bolivia

The third selection of ten countries are countries located on the African continent. They were selected based on factors relating to geography, demographics, importance of forests, levels of development and proximity to Kenya. Kenya was added to this making it a list of 11 countries.

Group C - African countries

a. Kenya
b. Nigeria
c. Ghana
d. Ethiopia
e. Uganda
f. Tanzania
g. Cameroon
h. South Africa
i. Botswana
j. Rwanda
k. Democratic Republic of Congo (DRC)

Since I am particularly interested in the policy capacities of developing countries, the last grouping is especially important as a representative sample of countries that share some significant social, political, and economic characteristics; for example, dependence on international agencies such as the International Monetary Fund (IMF), the World Bank and other bilateral agencies for various development projects including those concerned with the environment and specifically forest management. Also, it has been shown that it is more useful for policymakers to compare a

country's results with those in its peer group (IMF, 2006). Their similarities could act as a good basis for determining just how much central policy capacity plays a role in dealing with environmental challenges such as the effects of climate change, despite their varied levels of vulnerability. As stated before, the construction of the index is dependent upon access to readily available data, which was the case with the selected countries.

5.2 Construction of a Public Sector Capacity Index (the PSC)

Policy capacity involves aspects of construction and implementation of policy measures. The index will address both aspects. I used one data source to measure the policy capacity and operational efficiency of the selected countries. "Government effectiveness", an indicator measured by the World Bank's Worldwide Governance Index (WGI) was used. This indicator measures the technical competence of a country's public service, which often in turn affects the quality of policy advice that bureaucrats present to those who make the decisions (usually the cabinet). Indicators for operational efficiency are meant to measure efficiency or the quality of service provided by the public sector. Government effectiveness is therefore an inclusive measure of both policy capacity and operational efficiency because it is described as capturing "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies" (WGI, 2014).

Countries are rated based on data collected by different organizations measuring factors such as quality of bureaucracy or institutional effectiveness and excessive bureaucracy or red tape; infrastructure and the quality of primary education; satisfaction with public transportation system, satisfaction with roads and highways and satisfaction with the education system; the quality of the supply of public goods, education and basic health and the capacity of political authorities to implement reforms; and finally assessments of the quality of a country's bureaucracy. Bureaucracies are assessed on how quickly decisions are made and the ease in which foreign businessmen and investors can conduct business. Policy consistency and forward planning are also considered through the assessment of the continuity of economic policy stances which help in predicting potential policy disruptions in cases of political instability. This factor also looks at the

extent to which policy-making is "far-sighted or conversely aimed at short-term economic advantage" (World Bank, 2013).

Countries are given scores as percentages where a score of 0 equals weak performance and a score of 100 indicates good performance. For simplicity purposes, the numbers were divided by 10 in order to get scores on a scale of 0 to 10 where 0 equals weak government effectiveness/quality of public administration and 10 equals good government effectiveness/ quality of public administration. For example, Kenya's average score was 35.2% for the years 2007 to 2014 giving it a score of 3.52 out of a possible 10.

To measure the selected countries' ability to carry out decisions and enforce rules (implementation authority), I used data sourced from Transparency International's Corruption Perception Index (CPI). This index ranks countries and territories around the world according to perceived levels of public sector corruption. Countries are scored based on survey results indicating those perceived to be the most corrupt and those perceived to be the least corrupt. Countries are scored on a scale of 0 to 10 where 0 means highly corrupt and 10 equals clean, meaning no corruption. Public sector capacity elements, their indicators as well as data sources are summarized in Table 5.1 below.

Public Sector Capacity Index (the PSC)

Table 5.1 Summary of proposed indicators of public sector capacity

Element of public sector capacity	Indicator	What it measures	Data sources
Policy capacity	Quality of public administration/technical competence	Ability to provide policy advice	Worldwide Governance Indicators (WGI)
Implementation authority	Corruption	Ability to enforce rules uniformly	Transparency International's Corruption Perception Index (CPI)

Operational efficiency	Government effectiveness	Indirect measure of quality of service	Worldwide Governance Indicators (WGI)

As stated above, the PSC index is a simple average of the three category elements of policy capacity, implementation authority, and operational efficiency. These values represented data from 2007 to 2014. In the CPI, countries are scored on a scale of 0 to 10 where 0 means highly corrupt and 10 meaning clean or no corruption. In the WGI, countries are given scores in percentage form ranging from 0 to 100 where a score of 0 equals weak performance and a score of 100 indicates good performance. For simplicity purposes, the numbers were divided by 10 in order to get scores on a rating scale of 0 to 10 where 0 equals weak government effectiveness/quality of public administration and 10 equals good government effectiveness/ quality of public administration. Table 5.2 below shows the results for the selected countries from highest to lowest.

Table 5.1 Public Sector Capacity scores for all countries under study

RANK	GROUP	COUNTRY	CPI	WGI	PSC
1	A	Singapore	9.15	9.98	9.56
2	A	Sweden	9.18	9.84	9.51
3	A	New Zealand	9.32	9.6	9.46
4	A	Netherlands	8.82	9.53	9.17
5	A	Norway	8.55	9.77	9.16
6	A	Australia	8.67	9.51	9.09
7	A	Canada	7.45	9.56	8.50
8	A	UK	7.77	9.2	8.48
9	A	Japan	7.62	8.9	8.26
10	A	USA	7.25	9.14	8.2
11	C	Botswana	5.87	6.87	6.37
12	C	South Africa	4.6	6.71	5.65

13	B	China	3.7	5.84	4.77
14	B	Mexico	3.32	6.11	4.71
15	C	Ghana	4	5.42	4.71
16	C	Rwanda	3.9	5.2	4.55
17	B	Brazil	3.75	5.1	4.42
18	B	India	3.38	5.43	4.4
19	B	Colombia	3.22	5.36	4.29
20	B	Peru	3.58	4.43	4.0
21	B	Indonesia	2.78	4.63	3.70
22	C	Ethiopia	2.73	4.08	3.4
23	B	Bolivia	2.93	3.68	3.3
24	B	Russia	2.32	4.2	3.26
25	C	Cameroon	4.48	2.02	3.25
26	C	Tanzania	3	3.48	3.24
27	C	Uganda	2.62	3.59	3.1
28	C	Kenya	2.23	3.52	2.87
29	C	Nigeria	2.48	1.36	1.92
30	B	Venezuela	1.93	1.32	1.62
31	C	DRC	2	0.14	1.07

5.3 Construction of the Policy Capacity and Adaptability (PCA) Index

Environmental policy scholars note that the inclusion of different interdependent indicators in measuring adaptive capacity to climate change could provide a more useful overview and thus help in guiding policy direction (Abson et. al, 2012, Fussel, 2009). The PCA index presents an exploratory attempt at estimating countries' adaptive capacity to climate change using countries' biophysical indicators (environmental vulnerability) as well as governance indicators (public sector capacity) in the hope of determining whether policy capacity can be mobilized to reduce or offset environmental vulnerabilities. To measure this, the Environmental Vulnerability Index (EVI) will be incorporated into the PSC index shown above. Another environmental index, the

Environmental Performance Index (EPI) will be used for comparison purposes. These two environmental indices will be used to quantify not only countries' current policies and environmental protection efforts but also to numerically value their overall environmental vulnerability.

5.3.1 The Environmental Vulnerability Index (EVI)

The EVI index assesses the risk of damage to the health of ecosystems at the national level. It provides an analysis of indicators that assess "the risk of hazards occurring, the inherent resistance to damage and the acquired vulnerability resulting from past damage" (Kaly et al., 2005). The index places emphasis on ecosystem integrity and how it is threatened by anthropogenic and natural hazards. Each indicator is classified into a range of sub-indices including the three aspects of hazards, resistance, and damage and into policy-relevant sub-indices[3]. It was created by a group of geoscientists as a measure of the vulnerability of countries' natural environment, and to assist in the study of human welfare. The index resulted from a combined effort between the South Pacific Applied Geoscience Commission (SOPAC), the United Nations Environment Programme (UNEP), and their partners through consultation and collaboration with countries, institutions and experts across the globe. The EVI is fitting in this study because it is designed to be used with economic and social vulnerability indices to provide insights into the processes that can negatively influence the sustainable development of countries of which SFM is a part of. It started as an index to determine the vulnerability of small islands and island countries to the effects of not only global climate change and human-related or caused environmental disasters but also factors in environmental disasters like volcanoes, earthquakes, flooding, landslides, and tsunamis. This index is composed of 50 indicators which are categorized into seven sub-indices: climate change, biodiversity, water, agriculture and fisheries, human health aspects, desertification, and exposure to natural disasters. It also includes such factors as wind speed changes, temperature changes on a regional level, geographical relief, rainfall amount and vulnerability of a country's coastline, isolation, and whether a country is landlocked or not, and compares them to human impacts of the

[3] See Appendix A

land, the various industries in the country and the demographics of the country.

The EVI data was released in 2005 and considers the physical, geographical and geological effects on a country's environmental vulnerability. The EVI will, therefore, be used to represent "environmental status" in the PCA index. These geographical and geological effects do not change significantly over a span of 10 -15 years and were used experimentally to determine what kind of changes would result if taken into consideration. Therefore, the age of the EVI data was not considered a significant issue. Also, the index has not been updated since its initial release, so no other data of this type is available in an easily attainable and usable format. Calculating the EVI numbers to bring them to a scale of 0 to 10 was significantly more complex. Its numerical values were calculated on a theoretical scale of 0 to 1000, where both 0 and 1000 were completely unattainable in real world scenarios. These numerical values were further divided into seven groups, and assigned numbers relating to levels of vulnerability, for example, 4=vulnerable, 1=very vulnerable and 3=low vulnerability. For simplicity, the values grouped into 7 were ignored for this study and only the values calculated out of 1000 were used. A discussion of how EVI scores were calculated are attached in Appendix B.

It is important to note that because this is a geoscience-based study, it tries to take account of a country's vulnerability to all environmental effects, changes, and disasters. For example, Japan and the Netherlands in most environmental performance and policy indices have some of the highest scores in the world in terms of public sector capacity, while in this index they are ranked among the most vulnerable countries for reasons such as Japan's high risk of experiencing an earthquake or tsunami which would result in substantial destruction or the Netherlands which is especially prone to flooding because of how low it lies above sea level. The highest scores (those that are least vulnerable) go to countries that are landlocked, not on geological plate boundaries, might be sparsely populated and not heavily agriculturally developed (i.e. those countries with not much to lose and those that are unlikely to get hit by many natural disasters) while countries found on the Pacific Rim, for example, have lower scores (are most vulnerable) due to the subduction of tectonic plates resulting significantly higher chances of volcanic and orogenic activity that lead to earthquakes, volcanoes, and tsunamis. This index is based on observable change, so that a country that was already mostly desert-like for example, Western Sahara, will have a high score, because global climate change will not change that fact by much whereas countries like Kenya which is

currently undergoing change in forested areas could end up completely desert so they could get a lower score, because they have more to change and to lose. Table 5.3 below shows EVI country scores, from least vulnerable to most vulnerable.

Table 5.2 Environmental Vulnerability Index (EVI) scores for all countries

RANK	**GROUP**	**COUNTRY**	**EVI**
1	C	Botswana	9.09
2	C	Cameroon	7.75
3	A	Australia	7.49
4	B	Bolivia	7.05
5	A	Canada	7
6	C	Tanzania	6.78
7	C	Ethiopia	6.67
8	C	Kenya	6.59
9	B	Peru	6.42
10	B	Norway	6.18
11	B	Russia	6.17
12	C	Ghana	5.95
13	B	Brazil	5.84
14	C	Uganda	5.75
15	C	Dem. Rep. Congo	5.57
16	B	Venezuela	5.45
17	A	New Zealand	5.42
18	B	Colombia	5.26
19	C	Rwanda	5.16
20	A	United States	5.1
21	B	Mexico	4.87

22	A	Sweden	4.71
23	B	Indonesia	4.5
24	C	South Africa	4.27
25	C	Nigeria	3.92
26	B	China	3.27
27	A	United Kingdom	2.97
28	B	India	2.73
29	A	Netherlands	2.66
30	A	Japan	2.64
31	A	Singapore	2.08

The EVI country scores will then be averaged with the policy capacity country scores in the hope of determining whether policy capacity can be mobilized to reduce or offset environmental vulnerabilities.

5.3.2 The Environmental Performance Index (EPI)

The EPI is a report developed by Yale University to rank how well countries perform on "high priority environmental issues in two broad policy areas, protection of human health from the environment and protection of ecosystems" (YCELP, 2015). This index is constructed using 20 indicators representative of national-level environmental data. These indicators are then grouped into nine issue categories, each of which fit under one of two overarching objectives; environmental health (which measures the protection of human health from environmental harm) and ecosystem vitality (which measures ecosystem protection and resource management). These nine issue categories are air quality, forests, fisheries, water sanitation, water resources, agriculture, biodiversity and habitat and climate and energy (See Appendix C). The index ranks countries on changes in their environmental performance over the last decade and is meant to "provide a gauge at a national government scale of how close countries are to established environmental policy goals". Determining how close countries are to their environmental policy targets enables cross-country comparisons as well as analysis of how the global community is doing on each particular policy issue. countries are given values in percentage scores. For simplicity, the numbers were divided by 10 to get scores on a rating scale of 0 to 10 where 0 equals

weak performance and 10 equals the highest possible performance. For example, Australia's average score for the period of study was 82.4% giving it a score of 8.24 out of a possible 10. Table 5.4 shows the EPI scores for the selected countries.

Table 5.3 Environmental Performance Index (EPI) scores for all countries

RANK	**GROUP**	**COUNTRY**	**EPI SCORE**
1	A	Australia	8.24
2	A	Singapore	8.18
3	A	Sweden	7.81
4	A	Norway	7.8
5	A	Netherlands	7.78
6	A	United Kingdom	7.74
7	A	New Zealand	7.64
8	A	Canada	7.31
9	A	Japan	7.24
10	A	United States	6.75
11	B	Venezuela	5.78
12	B	Mexico	5.5
13	B	Russia	5.35
14	C	South Africa	5.35
15	B	Brazil	5.3
16	B	Colombia	5.08
17	B	Bolivia	5.05
18	C	Botswana	4.76
19	B	Peru	4.51
20	B	Indonesia	4.44
21	B	China	4.3
22	C	Ethiopia	3.94
23	C	Nigeria	3.92
24	C	Uganda	3.92

25	C	Kenya	3.7
26	C	Cameroon	3.67
27	C	Tanzania	3.62
28	C	Rwanda	3.54
29	C	Ghana	3.21
30	B	India	3.12
31	C	DRC	2.5

Since this index has aspects of both policy and environmental vulnerability among its indicators, it will be compared with the PCA index to determine whether the two indices give similar results and if there are significant differences, determine why. If the two are similar, then it means that they can be used interchangeably, however, the PCA will be a simpler way of determining environmental policy capacity because it requires the use of fewer indicators.

5.3.3 Comparing the EVI and EPI

The two indices both attempt to measure environmental challenges. The EVI focuses exclusively on environmental risk while the EPI includes a policy component. The correlation co-efficient between the two variables is 0.06 meaning that there is no correlation. This is demonstrated by the graph below which shows that there is no positive correlation between the two indices.

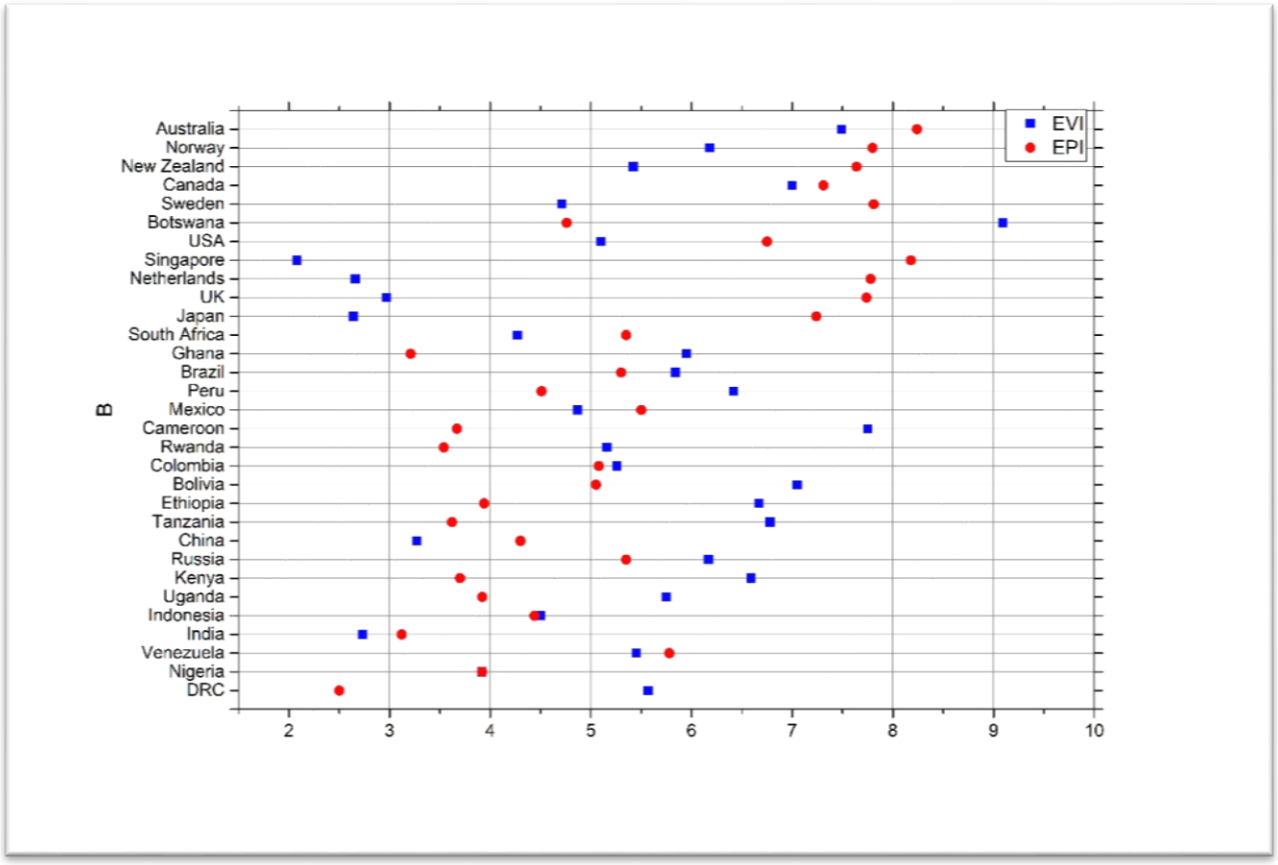

Figure 5.1 Correlation between EPI and EVI

The difficulty is that adding policy to the environmental measures does not visibly aid with understanding the environmental resilience across countries. For this reason, the rest of this chapter constructs and tests a simple PCA to supplement the risk-based EVI index in lieu of the more complex and less transparent EPI index.

5.3.4. The PCA Index

The PCA index is normalized on a rating scale of 0 to 10, with 0 indicating the worst possible score and 10 indicating the best possible score. The score for each country was derived by means of a simple average of scores of the two category indices' sub-elements scores; public sector capacity (PSC) and environmental vulnerability (EVI). These values represented data from 2007 to 2014.

The PCA attempts to answer the following questions:

1. How does Kenya compare with the rest of the world?
2. Where should the most focus and appropriate actions be directed to improve the country's performance with regard to SFM?
3. What lessons can Kenya learn from countries that seem to be doing well in SFM?

Table 5.5 below provides a summary of proposed indicators of the policy capacity and adaptability (PCA) index.

Policy Capacity and Adaptability (PCA) Index

Table 5.4 Summary of proposed indicators of the PCA index

Elements of Public Capacity & Adaptability	Sub-elements	What it measures	Data sources
Public Sector Capacity	— Policy capacity — Implementation authority — Operational efficiency	— Ability to provide policy advice — Ability to enforce rules uniformly — Quality of service	— Worldwide Governance Indicators (WGI) — Transparency International's Corruption Perception Index (CPI)
Environmental Status	— Environmental vulnerability	— Risk of damage to the	— Environmental Vulnerability Index (EVI)

health of ecosystems

Below is a comparison of all the countries under study. Table 5.6 shows individual scores for a representative sample of developed countries as well as how the countries rank compared to each other. All countries obtain an above average score (all above 6) with the highest being Australia and the lowest being Japan. The average PCA is significantly higher than the policy neutral EVI therefore, adding policy capacity clearly mitigates what at times is a significant risk.

Table 5.5 Group A - Developed countries

RANK	COUNTRY	CPI	WGI	PSC	EVI	PCA
1	Australia	8.67	9.51	9.09	7.49	8.56
2	Norway	8.55	9.77	9.16	6.18	8.17
3	New Zealand	9.32	9.6	9.46	5.42	8.11
4	Canada	7.45	9.56	8.5	7	8
5	Sweden	9.18	9.84	9.51	4.71	7.91
6	USA	7.25	9.14	8.2	5.1	7.16
7	Singapore	9.15	9.98	9.56	2.08	7.07
8	Netherlands	8.82	9.53	9.17	2.66	7
9	UK	7.77	9.2	8.48	2.97	6.65
10	Japan	7.62	8.9	8.26	2.64	6.39
AVG					4.625	7.5

Table 5.7 shows individual scores for a representative sample of BRIC plus 6 countries as well as how the countries rank compared to each other. As can be deduced from the table below, all the countries scored below average, with Brazil emerging highest at 4.9 and the lowest being Venezuela at 2.9. On average, adding the policy variable is mostly awash, with the average for the PCA not much different than for the policy neutral EVI.

Table 5.6 Group B - BRIC+6 countries

RANK	COUNTRY	CPI	WGI	PSC	EVI	PCA
1	Brazil	3.75	5.1	4.43	5.84	4.9
2	Peru	3.58	4.43	4.0	6.42	4.81
3	Mexico	3.32	6.11	4.71	4.87	4.77
4	Colombia	3.22	5.36	4.3	5.26	4.61
5	Bolivia	2.93	3.68	3.3	7.05	4.55
6	China	3.7	5.84	4.77	3.27	4.27
7	Russia	2.32	4.2	3.26	6.17	4.23
8	Indonesia	2.78	4.63	3.7	4.5	3.97
9	India	3.38	5.43	4.4	2.73	3.85
10	Venezuela	1.93	1.32	1.62	5.45	2.9
AVG					5.12	4.29

Table 5.8 shows individual scores for a representative sample of African countries. These results are quite interesting as demonstrated by Botswana's, South Africa's and Ghana's scores which are above average while the rest of the countries get scores below average. The lowest scoring country is the DRC while the highest is Botswana. In this case, adding policy capacity actually makes things worse, amplifying the ambient climate and environmental risks measured in the EVI. Kenya is not an exception to this regional challenge.

Table 5.7 Group C - African countries

RANK	COUNTRY	CPI	WGI	PSC	EVI	PCA
1	Botswana	5.87	6.87	6.37	9.09	7.28
2	South Africa	4.6	6.71	5.65	4.27	5.19
3	Ghana	4	5.42	4.71	5.95	5.12
4	Cameroon	4.48	2.02	3.25	7.75	4.75
5	Rwanda	3.9	5.2	4.55	5.16	4.75
6	Ethiopia	2.73	4.08	3.4	6.67	4.49
7	Tanzania	3	3.48	3.24	6.78	4.42
8	Kenya	2.23	3.52	2.87	6.59	4.11
9	Uganda	2.62	3.59	3.1	5.75	3.99
10	Nigeria	2.48	1.36	1.92	3.92	2.59
11	DRC	2	0.14	1.07	5.57	2.57
AVG					6.14	4.48

The table below shows individual country scores and rankings, from highest to lowest, for all the 31 countries under study.

Table 5.8 Ranking of all countries under study

RANK	GROUP	COUNTRY	CPI	WGI	PSC	EVI	PCA
1	A	Australia	8.67	9.51	9.09	7.49	8.56
2	A	Norway	8.55	9.77	9.16	6.18	8.17
3	A	New Zealand	9.32	9.6	9.46	5.42	8.11
4	A	Canada	7.45	9.56	8.5	7	8
5	A	Sweden	9.18	9.84	9.51	4.71	7.91
6	C	Botswana	5.87	6.87	6.37	9.09	7.28
7	A	USA	7.25	9.14	8.2	5.1	7.16
8	A	Singapore	9.15	9.98	9.56	2.08	7.07
9	A	Netherlands	8.82	9.53	9.17	2.66	7
10	A	UK	7.77	9.2	8.48	2.97	6.65
11	A	Japan	7.62	8.9	8.26	2.64	6.39
12	C	South Africa	4.6	6.71	5.65	4.27	5.19
13	C	Ghana	4	5.42	4.71	5.95	5.12
14	B	Brazil	3.75	5.1	4.43	5.84	4.9
15	B	Peru	3.58	4.43	4.0	6.42	4.81
16	B	Mexico	3.32	6.11	4.71	4.87	4.77
17	C	Cameroon	4.48	2.02	3.25	7.75	4.75
18	C	Rwanda	3.9	5.2	4.55	5.16	4.75
19	B	Colombia	3.22	5.36	4.3	5.26	4.61
20	B	Bolivia	2.93	3.68	3.3	7.05	4.55
21	C	Ethiopia	2.73	4.08	3.4	6.67	4.49
22	C	Tanzania	3	3.48	3.24	6.78	4.42
23	B	China	3.7	5.84	4.77	3.27	4.27
24	B	Russia	2.32	4.2	3.26	6.17	4.23
25	C	Kenya	2.23	3.52	2.87	6.59	4.11
26	C	Uganda	2.62	3.59	3.1	5.75	3.99
27	B	Indonesia	2.78	4.63	3.7	4.5	3.97

28	B	India	3.38	5.43	4.4	2.73	3.85
29	B	Venezuela	1.93	1.32	1.62	5.45	2.9
30	C	Nigeria	2.48	1.36	1.92	3.92	2.59
31	C	DRC	2	0.14	1.07	5.57	2.57

5.4 Discussion of the PCA Index

The PCA index showed that even if a country has good environmental policies, low levels of corruption, and good governance; geographical and geological environmental factors can weaken a country's ability to protect its own environment. The best example of this is Japan which has a very low EVI score (2.64). This can be explained by geological factors e.g. the Fukushima nuclear disaster which was caused by an earthquake and subsequent tsunami, resulting in radioactive material still being dumped into the ocean on a large scale years later. Another good example is Singapore which scores very highly in all categories except the EVI (2.08) because of its vulnerability to rising sea levels. During the 2004 Indian earthquake, if it had not been protected by the Sumatra landmass, the resulting tsunami would have caused monumental damage. Coupled with sea level rise due to climate change predicted at approximately a meter by 2100 (IPCC, 2013) and with the population of the country far outgrowing its available landmass, Singapore is facing serious issues that could distract and reroute funds and manpower away from its current environmental protection planning. The UK and Netherlands also score poorly in the EVI meaning they are highly vulnerable to the effects of climate change, however, their policy capacity scores manage to keep them among the top 11 countries. This proves that the higher a country's public sector capacity, the higher its ability to develop and implement policies that may help it mitigate the challenges posed by climate change. This is demonstrated below in Figure 5.2 which shows a positive correlation between public sector capacity (represented by PSC scores) and countries' abilities to adapt to environmental challenges (represented by PCA scores).

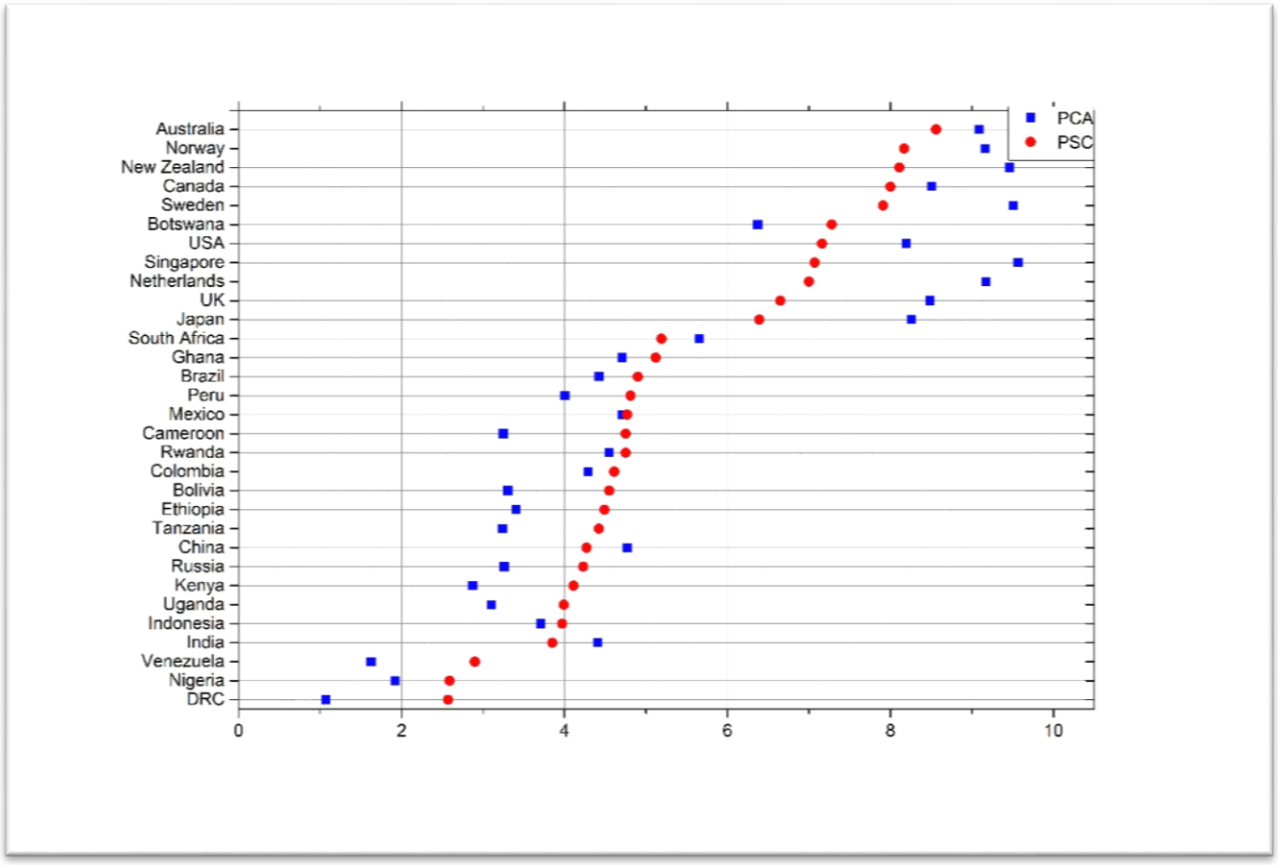

Figure 5.2 Correlation between policy capacity and environmental adaptability

The BRIC+6 countries performed poorly in the PCA with three of the countries being in the last five countries overall (India, Venezuela, and Indonesia). Even though most scored above average in the EVI except for India and China, all the countries scored below average in policy capacity. The set of countries is surpassed by African countries like Botswana, South Africa, and Ghana. China and Russia are surpassed by Tanzania and Ethiopia while Kenya did much better than India. The data set demonstrates that even though a country's environment may not be significantly vulnerable to the effects of climate change, government effectiveness and the issue of corruption, which are indicators of overall public sector capacity, undermine their adaptation efforts resulting in a very poor overall score. An example is Russia which scored 6.17 in the EVI but performs poorly in the CPI and WGI, thereby lowering its overall score significantly.

As mentioned above, there are some interesting outliers among the African grouping. Botswana scored above average in all the indicators except the EPI and manages to nudge out Japan, the US, Netherlands, Singapore and the UK to occupy the 6th spot. It performed significantly better than all the African and BRIC+6 countries in the CPI and WGI which goes to prove that policy capacity affects countries' ability to adapt to the effects of climate change and therefore achieve the goals of SFM. Other African countries that performed impressively include South Africa, Ghana, Cameroon, and Rwanda.

In summary, the PCA index suggests two important conclusions. Firstly, Kenya is ranked in the bottom fifth of all the countries on this list and the numbers show that it has poor public sector capacity when it comes to dealing with environmental challenges. The inclusion of the EVI actually raised Kenya's score significantly meaning that the probability of having significant natural disasters and geographic and geological threats is relatively small. Secondly, the top performing countries in the African grouping are Botswana, South Africa, and Ghana with Botswana actually getting into the top ten in this grouping of 31. This information leads to the question of what a sub-Saharan country like Botswana is doing to better manage its forests and what lessons countries like Kenya can learn from it. Another thing to note that wasn't in PCA index but was specifically in the CPI and WGI data if studied over the 5-year period is that Rwanda is a great example of how an African country in the same area can improve significantly after a period of bad governance and political turmoil.

As mentioned in the previous chapter, I will compare the scores in the PCA and the EPI to determine whether these two indices measure the same variables and whether there are similarities of differences between the two. A quick correlation shows that these two have a correlation coefficient of 0.83 and the variables move in the same direction suggesting there is there is a positive correlation between the EPI and the PCA. Essentially the PCA is correlated with EPI, as both have elements of policy, but now the PCA is positively correlated with EVI, whereas the EPI was negatively correlated. In short, the new index, with a much reduced set of variables, does a somewhat better job of reflecting the role of policy capacity in environmental resilience. This is captured below in Figure 5.3.

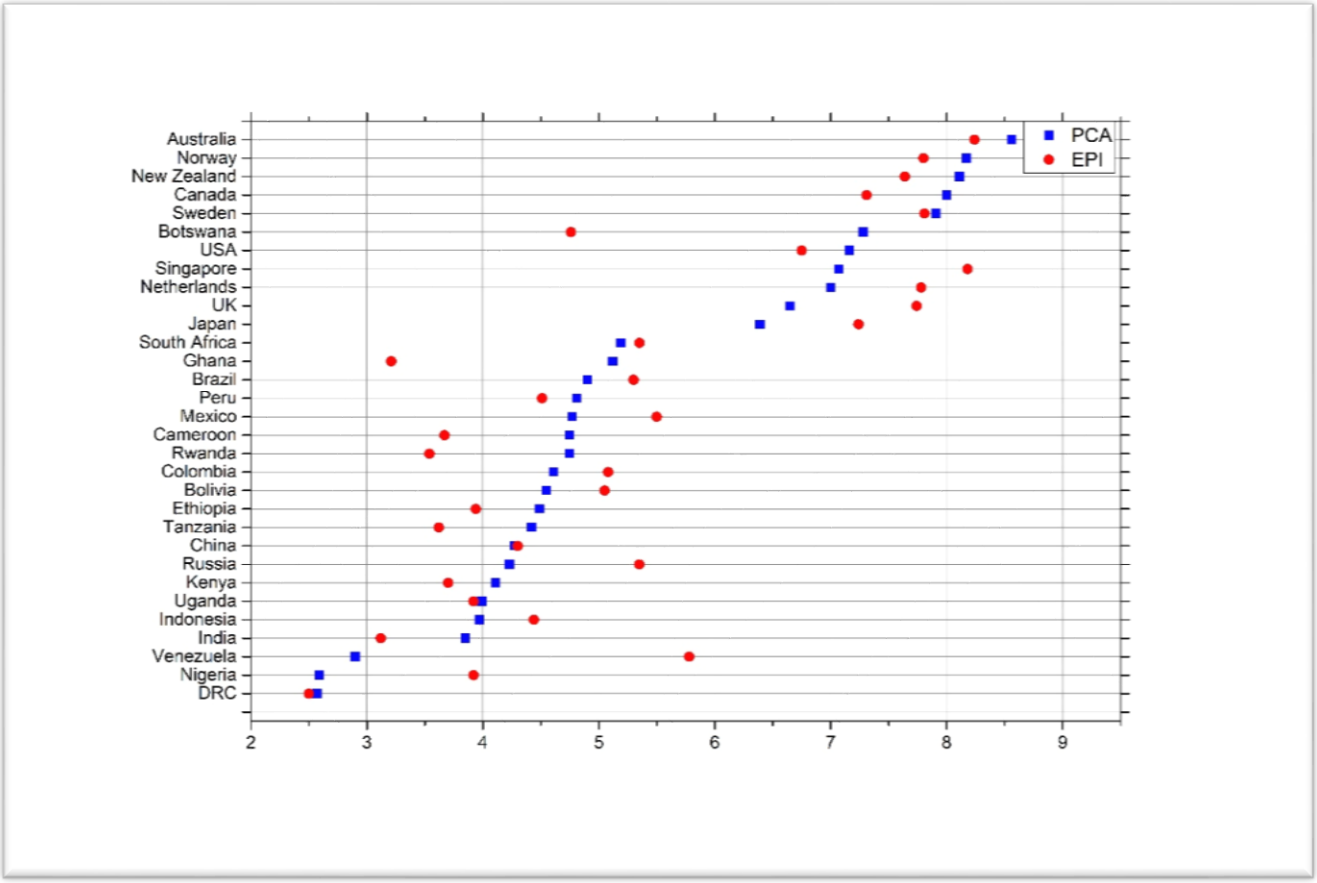

Figure 5.3 Correlation between EPI and PCA

The table below shows individual country scores for both the PCA and the EPI as well as how the countries differ in rankings.

Table 5.9 EPI and PCA country scores

GROUP	COUNTRY	EPI	RANK	PCA	RANK
A	Australia	8.24	1	8.56	1
A	Singapore	8.18	2	7.07	8
A	Sweden	7.81	3	7.91	5
A	Norway	7.8	4	8.17	2
A	Netherlands	7.78	5	7	9
A	UK	7.74	6	6.65	10

A	New Zealand	7.64	7	8.11	3
A	Canada	7.31	8	8	4
A	Japan	7.24	9	6.39	11
A	USA	6.75	10	7.16	7
B	Venezuela	5.78	11	2.9	29
B	Mexico	5.5	12	4.77	16
C	South Africa	5.35	13	5.19	12
B	Russia	5.35	14	4.23	24
B	Brazil	5.3	15	4.9	14
B	Colombia	5.08	16	4.61	19
B	Bolivia	5.05	17	4.55	20
C	Botswana	4.76	18	7.28	6
B	Peru	4.51	19	4.61	15
B	Indonesia	4.44	20	3.97	27
B	China	4.3	21	4.27	24
C	Ethiopia	3.94	22	4.49	21
C	Uganda	3.92	23	3.99	26
C	Nigeria	3.92	24	2.59	30
C	Kenya	3.7	25	4.11	25
C	Cameroon	3.67	26	4.75	17
C	Tanzania	3.62	27	4.42	22
C	Rwanda	3.54	28	4.75	17
C	Ghana	3.21	29	5.12	13
B	India	3.12	30	3.85	28
C	DRC	2.5	31	2.57	31

As can be observed above, the EPI and PCA scores do not vary by huge margins for most countries under study. This is especially so for the developed countries where we also observe a slight change in the order of rankings. For example, Australia has a score of 8.24 in the EPI and 8.56 in the PCA. They occupy 9 out of the top 10 positions. An interesting thing to note is that the inclusion of the corruption and overall government effectiveness (CPI and WGI) scores does not seem to

significantly impact scores for most of these countries, however, they do seem to make a difference in some of the BRIC+6 and the African countries. The scores change by less than 1 for most countries with the exception of Venezuela, Nigeria, Botswana, Rwanda and Ghana.

The country with the most significant difference in scores between the two indices is Botswana which has a 4.76 (18th overall) score in the EPI and scores very highly in the PCA at 7.28 (6th overall) and this can be explained using its CPI and WGI (policy capacity scores). It has very low levels of corruption of compared to all the African and BRIC countries under study and therefore this significantly brings up its score in the PCA. The other country with significant differences between the two scores is Venezuela which in the EPI has a score of 5.8 (11th overall) and 2.9 (29th overall) in the PCA. This can also be explained by the inclusion of corruption and overall government effectiveness scores in the PCA. The country scores are appallingly low in the CPI and WGI, and this significantly that brings down its total score in the PCA. It scores highly in the EPI due to its environmental protection laws which are enshrined in its constitution. This leads us to conclude that, even though African and BRIC+6 countries may be making the strides towards better environmental management, overall corruption and government effectiveness are factors that either hinder or promote progress towards achieving their goals. Below I discuss what lessons Kenya can learn from two select countries; Rwanda and Botswana which are countries that seem to be performing very well within the African group.

5.5 Lessons from similarly situated African countries

5.5.1 Botswana

Botswana is an example of a country where collaborative forest management seems to be working. The country's management of forests involves both decentralization as well as efforts from the central government. The Botswanan government does not have a stand-alone policy on decentralization but has done this through its National Development Plans which guide the country's overall development. Decentralization has been facilitated by policies such as the Tribal Grazing Lands Policy (TGLP), the Second Livestock Development Programme, the Tribal Grazing Lands Policy (TGLP), the Arable Lands Development Programme (ALDEP), and the Remote Area Resettlement Scheme. Forests and woodlands cover more than 60% of the country's land area and

these woodlands/forests are largely on tribal land. By 1998, over 20% of the land had been transferred to communities in Botswana through elected Land Boards, and to the private sector. There is also strong commitment within its public administration for this as demonstrated in the policy statements of the various development sectors of the economy. The PCA index clearly demonstrates this as Botswana scores very highly in comparison to other developing countries in terms of overall government effectiveness.

The draft National Forest Policy and its tools for implementation such as the Forest Act embrace the concept of decentralisation in forest management in the conservation, management and use of the country's forest resources. "Government agencies, both central and regional offices, reach out and strive to empower other entities in the national effort of achieving sustainable forest management". There are ten administrative districts in the country with Forestry Division offices in each of these. At an extension area level (comprising one or more villages), there are forestry technical assistants working with the communities in the protection, conservation and management of forest resources. The Forest Authority also consults a broad range of forestry stakeholders which is tenet of good governance and contributes to knowledge exchange.

The government also supports Community Based Natural Resource Management (CBNRM) programs as a rural development and conservation strategy in the sustainable management of resources. The government itself says that it "recognizes that program success may require more decentralized and participatory management of designated protected areas" (FAO, 2004).

Decentralization efforts have enabled rural communities to have easier access to government decision makers thus communicating their top priorities, forging new relationships and increasing their policy capacity through the exchange of knowledge with different stake holders. Through easier access to natural resources was previously controlled by the central government, some rural communities have been able to retain or acquire financial benefits from their natural resources (Shackleton et al. 2002).

5.5.2 Rwanda

Rwanda is a country that demonstrates how an improvement in overall governance can have a positive impact on the country's forest management. Rwanda's National Forest Policy won the 2011 Future Policy Award as the world's most inspiring and innovative forest policy. The policy was recognized for being "the most effective contributor to the conservation and sustainable development of forests for the benefit of current and future generations" as announced by the World Future Council in 2011, at the United Nations Headquarters.

The policy has been credited with the halting of deforestation, seeing an increase in the country's forest area by an impressive 37% since 1990. The success can be attributed to the government's huge reforestation projects and plantations carried out collaboratively with the local population.

The policy was also recognized for its inclusion of steps that valued interdependencies between agriculture and forestry, sustainable resource management, and education centred on forests.

"(We decide to) … facilitate effective development and implementation of local and national programs on afforestation, reforestation, restoration of degraded lands as part of a national strategy to effectively halt and reverse deforestation and forest degradation" (Republic of Rwanda, 2009).

Although effective implementation and compliance with laws remain a problem in many countries, when it comes to Rwanda's environmental policies, this is not the case. In a follow-up study of the country, the World Future Council attributed this to the way regulations are enforced within the country. A top-down approach is followed through various institutions concerned with environmental policy. Rwanda is divided into five provinces containing 30 districts and 416 sectors, followed by cells and villages.

"The implementation of the law is enforced on all levels by citizens, local police, sector and cell facilities. Functioning institutions on all levels seem to be the key along with local citizens who are aware of the value of trees to their community". The community is required by the government to be actively involved in carrying out activities that contribute towards sustainable forest management. This system is known as "Umuganda", which translates roughly to "collective effort". Umuganda which takes place on the last Saturday of each month involves the participation

of all residents between 18 and 65 in communal activities such as repairing public buildings, building homes for the poor, cleaning the streets, cutting shrubs and planting trees. Citizens are also given an opportunity to share their opinions, views and needs on different issues. Umuganda is also used as an opportunity to educate the people on their forests through information campaigns and training courses which are intended to foster an appreciation for forests as well as teach sustainable methods for their cultivation.

The policy also strongly promotes agroforestry with strong emphasis on combining traditional techniques with modern scientific knowledge. While the idea is not new in Africa, with its long tradition of planting trees on agricultural land, until recently, the prevailing paradigm was that forests and trees have to be protected against human activities. One of the keys to Rwanda's improvement is that the government freely admits the following:

Rwanda's government identified bad management of natural resources such as land, forests and water as the main reason for its environmental challenges. There are also problems caused by industrial, commercial and human settlement activities and various pollutions. The production and management of waste constitute also a challenge to environment quality, particularly in urban areas. Rwanda has publicly recognized its failings, admits the problems it faces, recognized environmental concerns as one of its country's top priorities, has a clear and defined mandate, has set implementation as a priority and goal, and top levels of government are determined to follow through on the goals that have been set.

Conclusion

As can be seen above, Kenya performed poorly in the Policy Capacity and Adaptability (PCA) Index. The country is ranked in the bottom fifth of all the countries on this list and the index demonstrates that it has poor public sector capacity when it comes to dealing with environmental challenges. The data set also demonstrates that even though the country's environment may not be significantly vulnerable to the effects of climate change compared to the other countries under study, overall government effectiveness and the issue of corruption, which are indicators of overall public sector capacity, undermine their adaptation efforts thereby resulting in a very poor overall score. This means that for Kenya to be able to enhance its adaptive capacity to climate change, the

country must direct efforts towards improving these two challenges. Botswana and Rwanda are countries that demonstrate how a focus on overall improvement in governance (e.g. reduction in corruption as well as collaborative management) have contributed towards improving their adaptive capacity to climate change.

CHAPTER 6

CONCLUSION AND POLICY IMPLICATIONS

6.1 Summary

Sustainable Forest Management in Kenya faces many challenges and climate change and the subsequent adaptation to its effects on the environment poses an additional challenge. In order to achieve the goals of SFM in an uncertain future, it is vital that stakeholders possess the ability to make innovative and locally relevant decisions related to climate change adaptation. The inclusion of the challenge of climate change in Kenyan forest policy making therefore seems like a logical consideration in forest management planning.

There are divergent views on which actors should take the lead in adaptive forest management. While the debate is a complex one that takes place in the context of the multilevel governance of forests in most parts of the world, part of the disagreement revolves around the development of the appropriate capacities for adaptive management. As is clear from much of the literature on adaptive collaborative management, some believe that these capacities need to be developed at the local level, where those whose livelihoods depend on forest health make day to day decisions. At the very least, on this view, local communities need to be actively engaged in decisions about forest use.

Even though adaptive capacity to deal with climate risks is closely related to a country's overall sustainable development and governance, in Kenya, absolute centralization has had negative consequences on SFM. Climate adaptation and equity goals in Kenya therefore, need to be jointly pursued through initiatives that promote the inclusion of stakeholders and particularly those most affected by the impacts of climate change such as the poorest and forest-dependent communities. Enhancing adaptive capacity is a necessary condition for reducing vulnerability, particularly for the most vulnerable regions, nations, and socio-economic groups. These efforts would have to be reinforced by strong overall national capacity that includes adequate provision of knowledge,

technology, policy, and financial support. Kenya's development decisions, activities, and programs play important roles in modifying the adaptive capacity of communities and should take into account risks associated with climate variability and change. This omission in the design and implementation of many recent and current development initiatives could result in unnecessary additional loss of life, important ecosystems as well as have adverse effects of the economy.

The findings support the expectation that higher/more central policy capacity has an influence on adaptive capacity and may be able to mitigate the vulnerabilities countries face as a result of exposure to the effects of climate change. The statistical analysis discussed above suggests that in many cases overall public sector capacity contributes to better environmental outcomes. From the example of Rwanda, it can be argued that societies that accept the inevitability of change and embrace collaborative learning and dialogue between government and its' citizens that results in effective climate change responsive planning and action, are better equipped to deal with the challenges of climate change in SFM. An important realization from this conclusion is that if ideal conditions in the form of public sector capacity do not exist, people and institutions will have great difficulties designing and implementing effective adaptation strategies. Where governance is weak, and where collaboration between the central government and its' citizens is weak, there is concern that the goals of SFM may be especially difficult to achieve

6.2 Policy Implications

This research informs two policy recommendations for sustainable forest management in the face of the impacts posed by climate change.

The first recommendation is for climate change for the integration of climate change risks into Kenya's development policies especially the most vulnerable sectors in the country e.g. agriculture, tourism, wildlife, water and energy. Climate change management has not necessarily been institutionalized in developing countries. The inclusion of adaptation and mitigation in annual operative plans and budget allocations is an important step a government must take in preparation for current and future climate-related impacts on sustainable forest management. Making decisions under the uncertainty of climate change and its effects requires that public officials and policy makers move away from a traditional approach, on to an approach that considers dynamic

planning processes and steers away from the ideas of permanence, stability, and absolute options. The country also needs to pursue sustainable economic growth which, in turn, contributes towards overall national capacity and allows for greater dedication of resources to development of adaptive technologies and innovations.

The second recommendation is the establishment of social institutions and arrangements that discourage concentration of power in a few hands and prevent marginalization of sections of the local populations. The establishment of partnerships between central and regional/local governments can provide a unique opportunity to test potential models for the design of national programs, generate experience, and strengthen partnerships between urban and rural communities. Similar opportunities can also come from collaboration with other key stakeholders, such as indigenous peoples, local communities, youth, women and the private sector which can promote the creation and consolidation of national and climate change policies. These arrangements need to consider representativeness of decision-making bodies and the Identification and prioritization of local adaptation measures and provision of feedback to higher levels of government.

6.3 Implications for Further Research

Although this study provides useful results and suggestions for measuring policy capacity, it has a number of limitations and further studies can strengthen the findings.

As demonstrated in the thesis, Polidano index of central policy capacity is dependent upon the use of many variables, and those that are readily available. This leaves room for future research and experimentation with creating a more nuanced index covering only those related specifically to climate change and SFM policy implementation. This is of course reliant on the availability of data therefore the gathering and managing of information knowledge, tools and strategies by and for developing countries is crucial. Even though it is impossible to eliminate uncertainty, the identification of trends and effective strategies can facilitate the definition of more suitable responses to climate change impacts. Environmental policymakers, especially in developing countries like Kenya, should move to establish better data collection, methodologically consistent reporting, mechanisms for verification, and a commitment to environmental data transparency.

The findings in the thesis do appear to support the expectation that higher/more central policy

capacity contributes towards mitigating the vulnerabilities countries face as a result of exposure to the effects of climate change. However, since the construction of the index is dependent on readily available data most of which was based on central policy capacity, designing an index to measure local capacity proved to be a challenge. In order to avoid biases in future studies, there is a need for the consolidation of local capacities in determining adaptation to climate change. This may require on-the-ground research.

APPENDIX A

EVI INDICATORS AND SUB INDICATORS

INDICATORS	TYPES	ASPECTS	SUB INDICES
High Winds	Weather & climate	Hazards	CC D CCD
Dry Periods	Weather & climate	Hazards	CC D AF W CCD
Wet Periods	Weather & climate	Hazards	CC D AF W CCD
Hot Periods	Weather & climate	Hazards	CC D CCD
CC Cold Periods	Weather & climate	Hazards	D CCD
Sea Temperatures	Weather & climate	Hazards	CC AF CBD
Volcanoes	Geology	Hazards	D
Earthquakes	Geology	Hazards	D
Tsunamis	Geology	Hazards	D
Slides	Geology	Hazards	D
Land Area	Geography	Resistance	CC CBD
Country Dispersion	Geography	Resistance	CC CBD
Isolation	Geography	Resistance	CBD
Relief	Geography	Resistance	CC CCD CBD
Lowlands	Geography	Resistance	CC CCD CBD
Borders	Geography	Resistance	CBD
Ecosystem imbalance	Resources & Services	Damage	CBD
Environmental openness	Resources & Services	Hazards	CBD
Migrations	Resources & Services	Resistance	CBD
Endemics	Resources & Services	Resistance	CBD
Introductions	Resources & Services	Damage	CC CBD
Endangered species	Resources & Services	Damage	CBD
Extinctions	Resources & Services	Damage	CBD

Vegetation cover	Resources & Services	Damage	W CCD CBD
Loss of cover	Resources & Services	Hazards	W CCD CBD
Habitat fragmentation	Resources & Services	Damage	CBD
Degradation	Resources & Services	Damage	W CCD
Terrestrial reserves	Resources & Services	Hazards	W CBD
Marine reserves	Resources & Services	Hazards	CBD
Intensive farming	Resources & Services	Hazards	
Fertilizers	Resources & Services	Hazards	HH W
Pesticides	Resources & Services	Hazards	HH W
Biotechnology	Resources & Services	Hazards	
Fisheries	Resources & Services	Hazards	
Fishing effort	Resources & Services	Hazards	
Renewable water	Resources & Services	Hazards	CC HH W CCD
SO_2 emissions	Resources & Services	Hazards	HH
Waste production	Resources & Services	Hazards	
Waste treatment	Resources & Services	Hazards	HH W
Industry	Resources & Services	Hazards	
Spills	Resources & Services	Hazards	
Mining	Resources & Services	Hazards	
Sanitation	Resources & Services	Hazards	HH
Vehicles	Resources & Services	Hazards	
Population	Human population	Damage	CC D W
Population growth	Human population	Hazards	W
Tourists	Human population	Hazards	
Coastal settlements	Human population	Damage	CC D
Environmental agreements	Human population	Hazards	
Conflicts	Human population	Damage	

CC=Climate Change; D=Exposure to natural disasters; HH=Human health; AF=Agriculture & Fisheries; W=water; CCD=Desertification; CBD=Biodiversity.

APPENDIX B

EVI INDEX CALCULATION

The EVI was significantly more complex, its numerical values were calculated on a theoretical scale of 0 to 1000, where both 0 and 1000 were completely unattainable in real world scenarios. Also, these numerical values were further divided into seven groups and assigned numbers relating to levels of vulnerability like 4=vulnerable, 1=very vulnerable and 3=low vulnerability. These values grouped into 7 were ignored for this study and only the values calculated out of 1000 were used. Also, in the EVI, no values over 436 and no values under 176 were obtained creating a centralized numerical grouping if converted directly to a 0-10 scale which would place all the numbers on the scale between 1.7 and 4.4. Therefore, a statistical dispersion method was used to adjust the data to a more usable scale. First to calculate the scale for calculating dispersion the numerical difference from the 0 to the lowest value on the index (174) was added to the top value (436) which was 610 (176+436). Half of 610 is 305. All values in the index were divided by 100, so this number was calculated as 3.05 and rounded to simply 3. After each number in the EVI was divided by 100, the 2nd step was to multiply by 2, since all the numbers were found to be numerically lower than 5, this was used to normalize the values to give an appearance of being on a 0-10 scale. The next step after that was to identify the median number, the EVI had an even number of countries so two median numbers were used. Also, it was important to recognize that there are 234 countries on the EVI and that half of that is 117. To determine a number to provide an even distribution ratio, 3 was divided by 117 to get .025641. Starting from the middle two numbers .025641 was added to the first middle number till running out of numbers to add to going up in value and then using the second middle number subtracted .025641 to each number till no numbers were left to subtract from decreasing in value. For example, the first middle number is 304 which was then divided by 100 then multiplied by 2, then .025641 was added to it to get 6.105641 then added .025741 to 6.105641 that got the 2nd number from the middle number increasing in value, then added .025641 to that number to get the 3rd number from the first middle value and so on till there were no more numbers to add to.

This created a usable index evenly distributed between 0-10 in order to be compared with the PCA index.

APPENDIX C

EPI INDICATORS

Source: YCELP, 2015

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